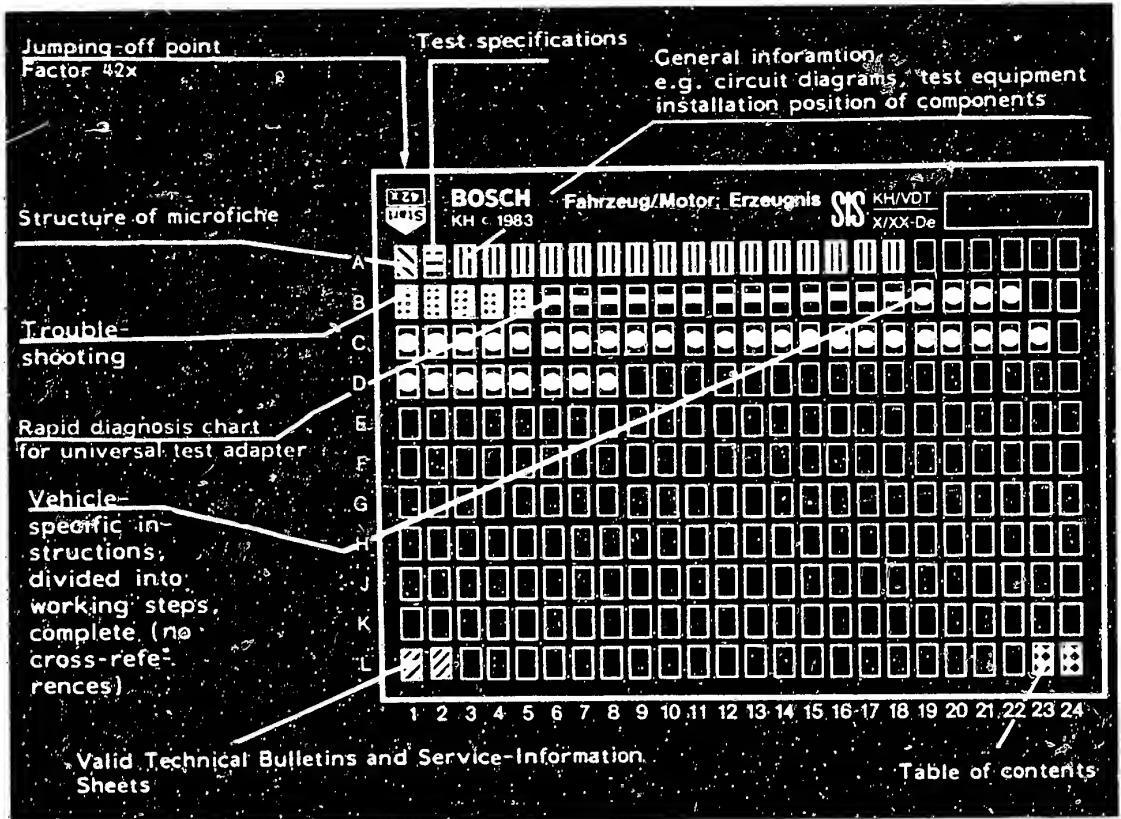


# Microfiche layout



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

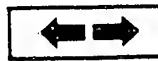
<b>E 16</b>	Product/assembly/test step	
	Vehicle/engine	

↑ Coordinate

3. Limits of section



Beginning



Mid-section



End



One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

**C 6**

**A1**

Trouble-Shooting Plan



## 1. Test specifications

Throttle-valve potentiometer:

Total resistance between term. 11  
and term. 20 3.2...4.8 k $\Omega$

Resistance between wiper term. 8  
and term. 20 250...750  $\Omega$

(Potentiometer removed and in rest position)

**B23**

Pulse generator for cylinder  
recognition: approx. 0  $\Omega$

Knock sensor internal resistance 270...330 k $\Omega$

Knock sensor tightening torque 11...15 Nm

Solenoid-operated valve internal  
resistance 18...45  $\Omega$

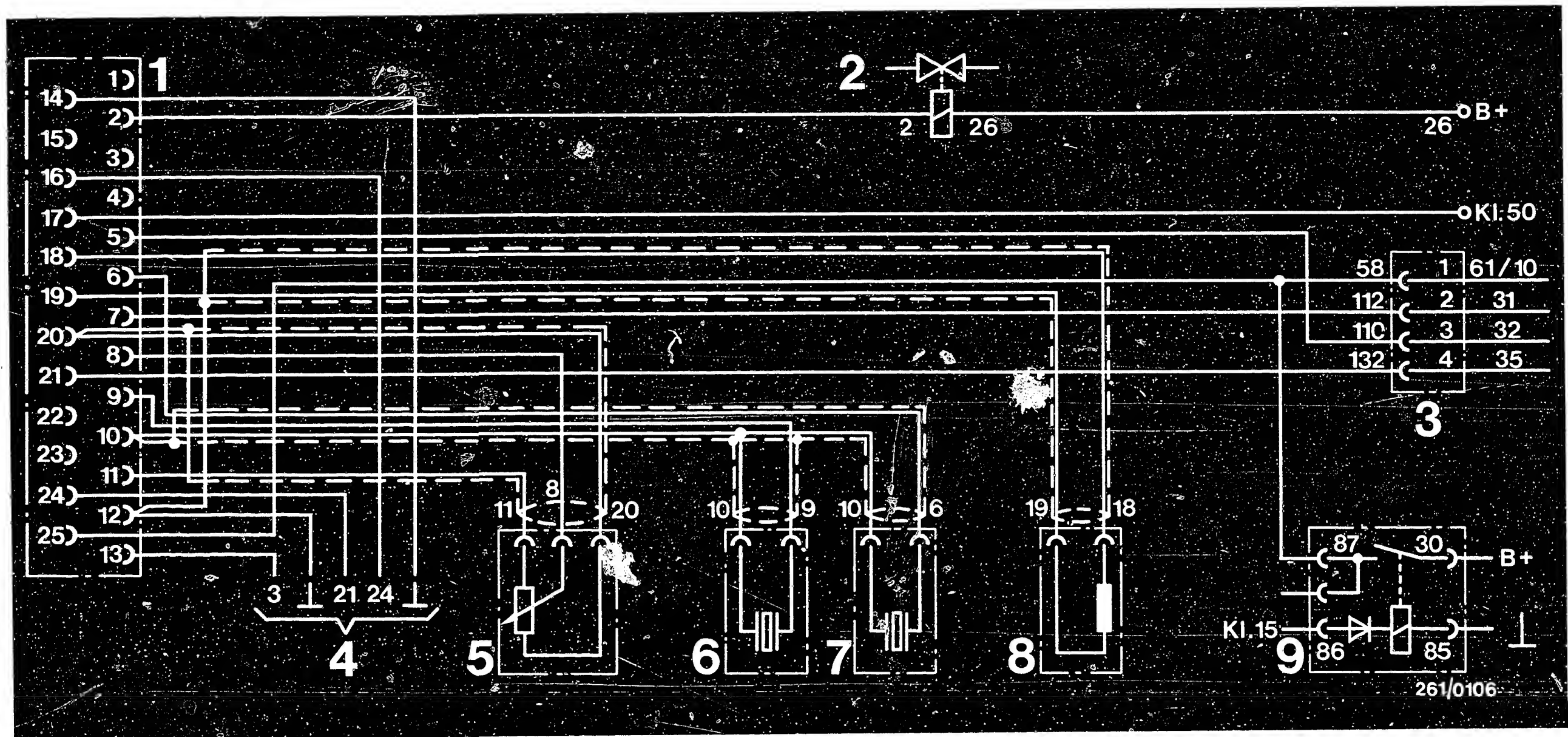
Voltage supply for knock  
control unit: 9 V ... U<sub>B</sub>

**A2**

Test specifications

BMW knock and charge-air pressure control





1 = Plug to knock control unit  
 2 = Solenoid-operated valve for wastegate  
 3 = Plug to transmission control

4 = Connection to Motronic  
 5 = Potentiometer on throttle shaft  
 6 = Knock sensor 1 between cylinders 1 and 2

7 = Knock sensor 2 between cylinders 5 and 6  
 8 = Pulse generator for cylinder recognition  
 9 = Relay 2 (main relay of Motronic)

## 2. Electrical terminal diagram

**A3**

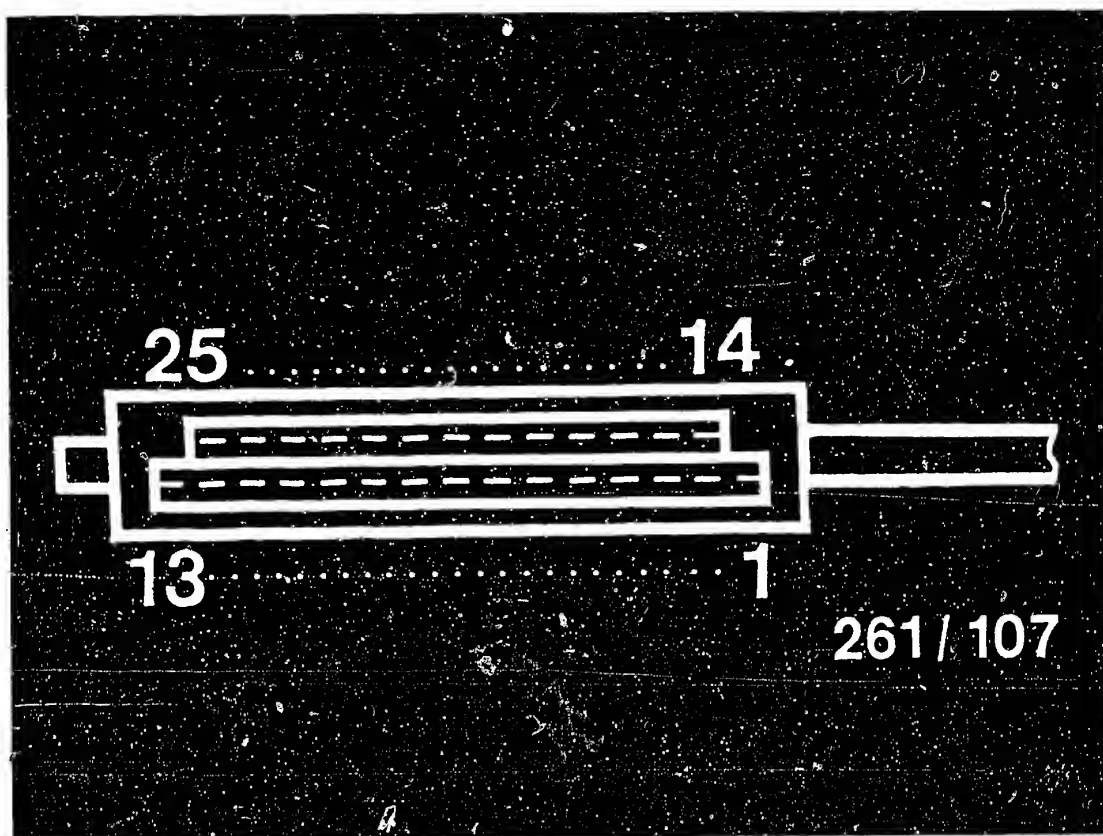
Electrical terminal diagram  
 BMW knock and charge-air pressure control



**A4**

Electrical terminal diagram  
 BMW knock and charge-air pressure control





261 / 107

- |  |  |
|--|--|
| 1 = Unoccupied   | 14 = Vehicle ground, output stage                      |
| 2 = Solenoid-operated valve, negative                  | 15 = Unoccupied  |
| 3 = Diagnostic output                                  | 16 = Spark-advance signal, output                      |
| 4 = Unoccupied   | 17 = Starting motor term.50                            |
| 5 = Reference-mark signal                              | 18 = Pulse generator for cylinder recognition, ground  |
| 6 = Knock sensor 2                                     | 19 = Pulse generator for cylinder recognition          |
| 7 = Engine-speed signal                                | 20 = Throttle-valve potentiometer, negative and screen |
| 8 = Throttle-valve potentiometer, wiper                | 21 = Output, knock control active                      |
| 9 = Knock sensor 1                                     | 22 = Unoccupied  |
| 10 = Knock sensors 1 and 2 and screen                  | 23 = Unoccupied  |
| 11 = Throttle-valve potentiometer, positive            | 24 = Spark-advance signal, input                       |
| 12 = Vehicle ground and screen of cylinder recognition | 25 = Power supply, positive                            |
| 13 = Full-load function                                |  |

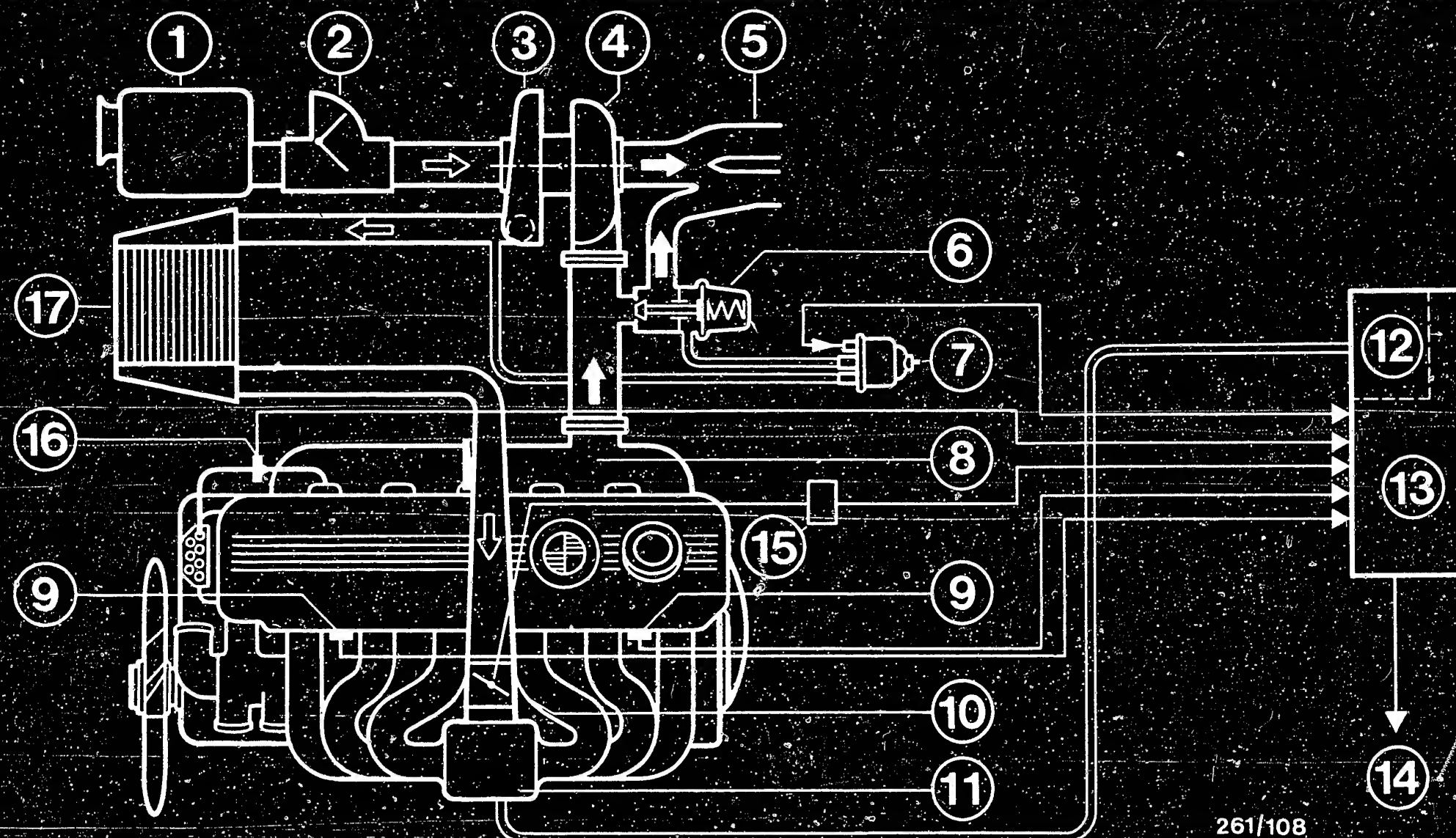
2a Pin assignment plan for knock control unit  
Top view of multiple plug

**A5**

Pin assignment plan

BMW knock and charge-air pressure control





261/108

- 1 = Air filter
- 2 = Air-flow sensor
- 3 = Compressor
- 4 = Exhaust turbine
- 5 = Front exhaust pipes
- 6 = Wastegate

- 7 = Solenoid-operated valve
- 8 = Exhaust manifold
- 9 = Knock sensors
- 10 = Throttle valve
- 11 = Intake manifold
- 12 = Pressure sensor in knock control unit

- 13 = Knock control unit
- 14 = To Motronic/transmission control unit
- 15 = Throttle-valve potentiometer
- 16 = Pulse generator for cylinder recognition
- 17 = Charge-air cooler

### 3. Basic diagram

**A6**

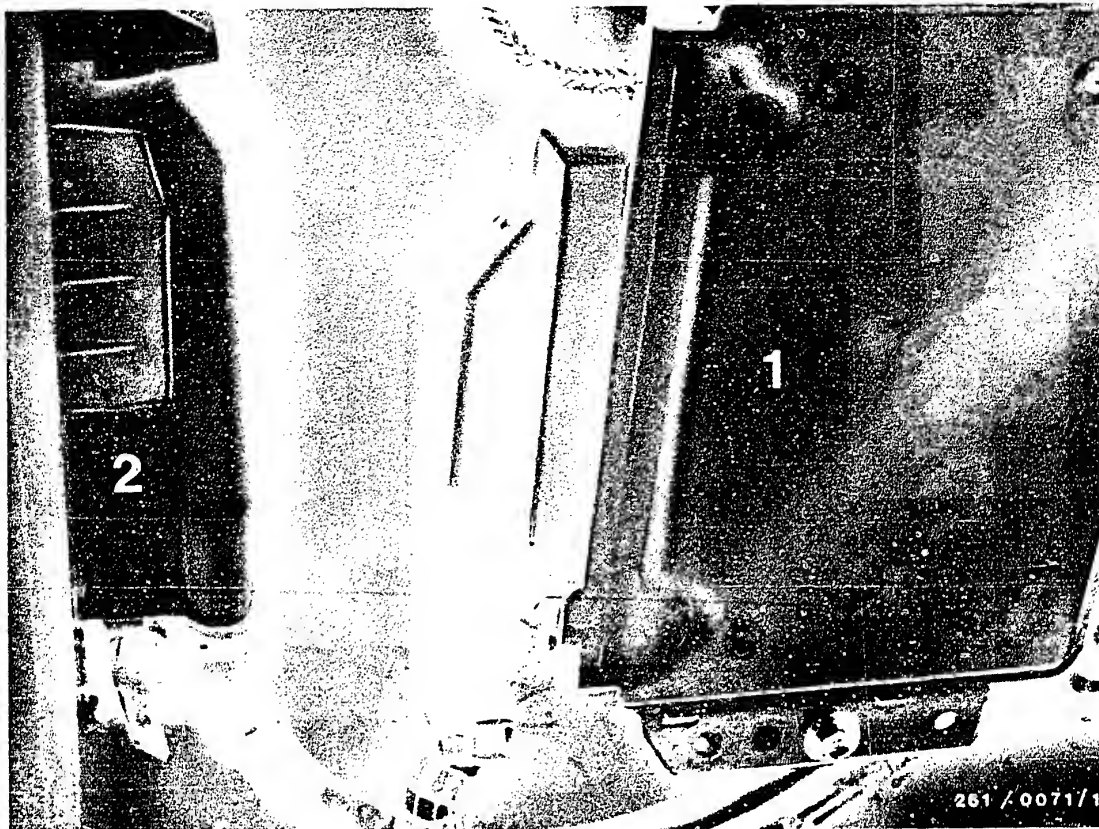
Basic diagram  
BMW knock and charge-air pressure control



**A7**

Basic diagram  
BMW knock and charge-air pressure control





1 = Knock control unit (25-pin plug)

2 = ABS controller (35-pin plug)

#### 4. Installation position of components

The knock control unit is in the glove compartment behind a cover.

Pull down cover with rail.

The knock control unit is fastened in position by 2 screws.







1 = Knock sensor between cylinders 1 and 2

The two knock sensors are on the engine block between cylinders 1 and 2 and between cylinders 5 and 6.

Notes:

Electric terminal at top.

Install knock sensor fastening screw without washer, spring lock washer, tooth lock washer etc.

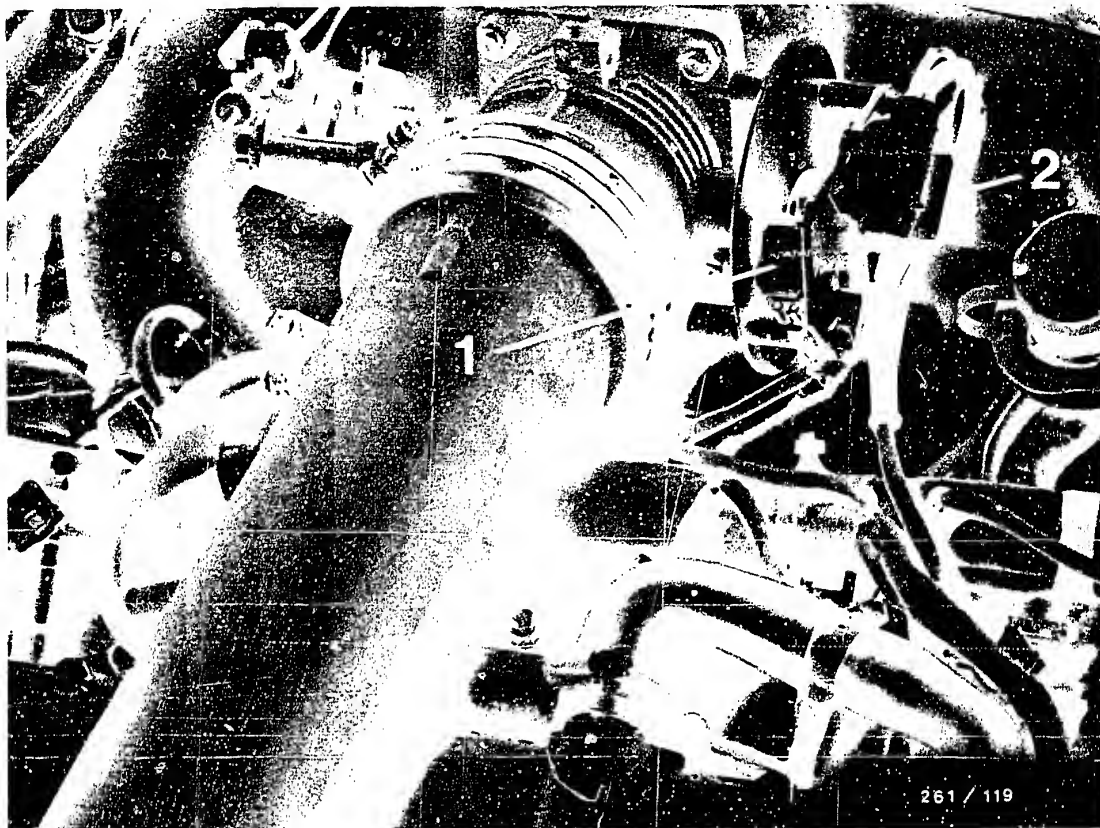
Tightening torque            11 ... 15 Nm

Secure fastening screw only with locking paint.

Knock sensors 1 and 2 must not be mixed up.

Knock sensor 1 between cylinders 1 and 2 to knock control unit term. 9 and term. 10. Knock sensor 2 between cylinders 5 and 6 to knock control unit term. 6 and term. 10.





1 = Microswitch

2 = Potentiometer

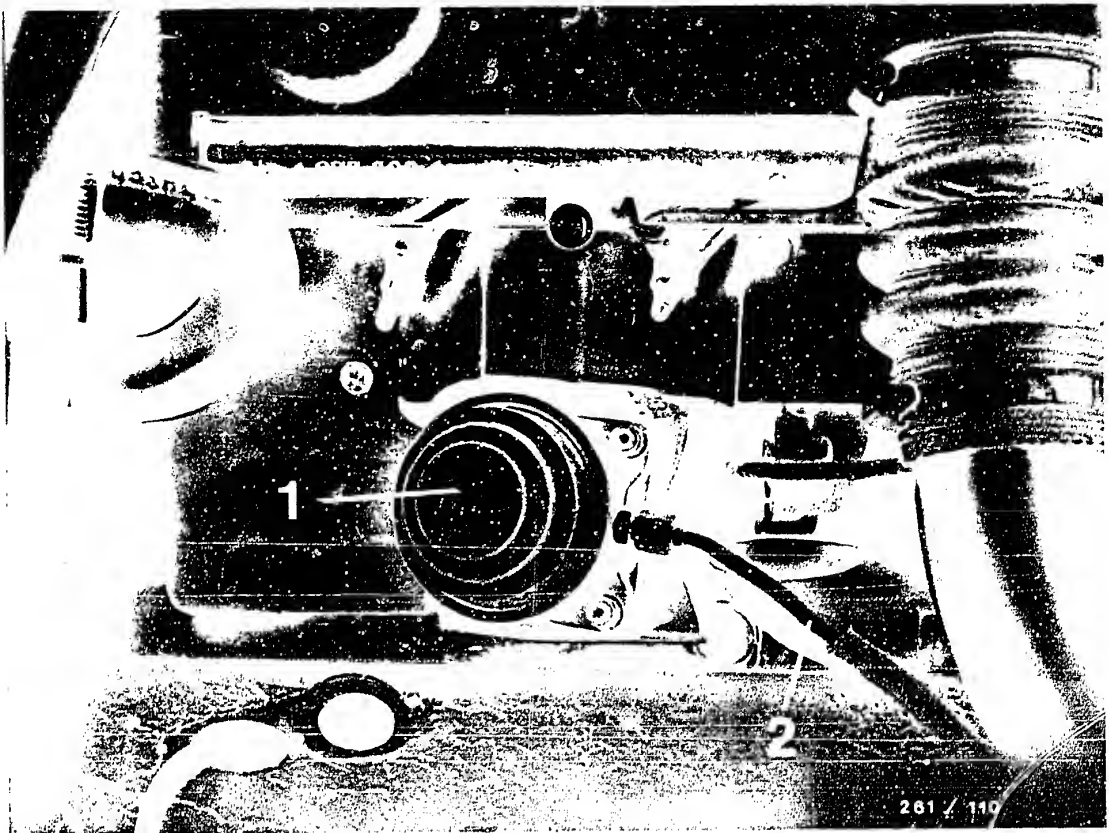
The throttle-valve potentiometer is mounted on a mounting plate on the throttle-valve assembly and is covered with a rubber hood.

**A10**

Installation position of components  
BMW knock and charge-air pressure control







1 = Wastegate

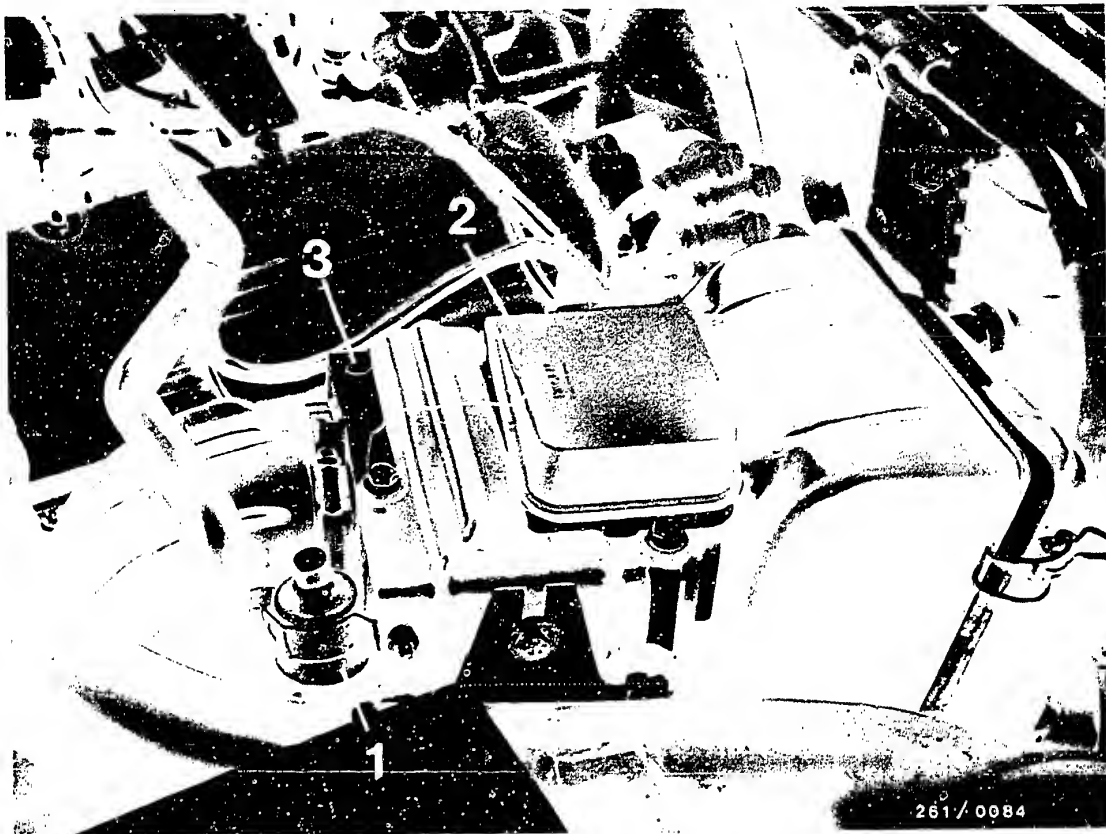
2 = Control line to solenoid-operated valve

The wastegate is on the exhaust in the engine compartment.

**A11**

Installation position of components  
BMW knock and charge-air pressure control





1 = Solenoid-operated valve  
2 = Air-flow sensor

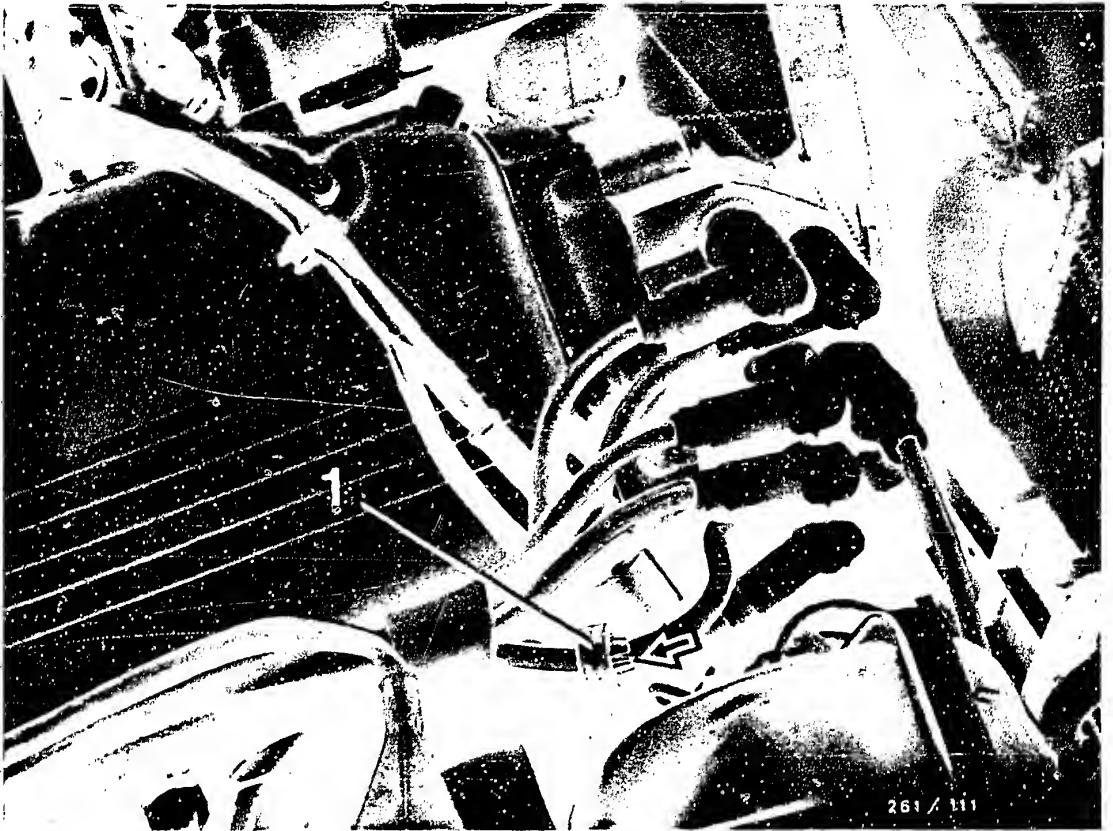
3 = Idle-mixture-adjusting  
screw

The solenoid-operated valve is in the engine compartment  
next to the air-flow sensor.

**A12**

Installation position of components  
BMW knock and charge-air pressure control





1 = Pulse generator

Arrow = Mark

The pulse generator is slipped over the H.T. ignition cable to cylinder 1 between high-voltage distributor and spark plug.

Make sure that it is installed in the correct direction.

Mark (arrow) must point in direction of high-voltage distributor.

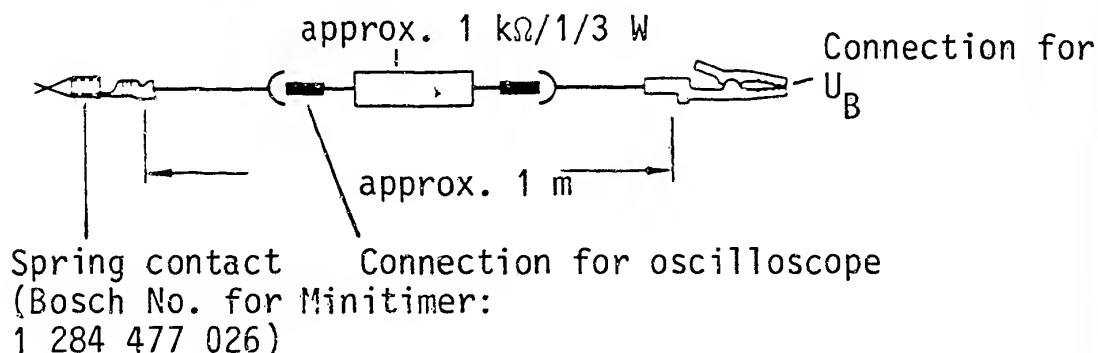
**A13**

Installation position of components  
BMW knock and charge-air pressure control



## 5. Necessary test equipment and aids

<u>Description</u>	<u>Designation</u>	<u>Part No.</u>
Universal test adapter	ETT 018.01	0 684 101 801
Adapter lead for transmission control		1 684 463 140
Motortester	e.g. MOT 002.00 or 200 or MOT 201	0 684 000 200  0 684 000 201
Multimeter (analog display, internal resistance min. 20 k $\Omega$ /V)		Commercially available e.g. Metrawatt GmbH, Type MA 2 H or Chinaglia, Type Cortina
Torque wrench 5 ... 60 Nm		Commercially available
Screw locking paint 30 g for knock sensor		5 703 245 003
Test lead (for user-fabrication) for testing the diag- nostic signal		



## 6. Important general information

Knock control and Motronic are functionally interrelated. Therefore, this manual also includes special references to the Motronic.

Be sure to follow these references so as to prevent damage to engine, control unit or ignition coil, and to prevent danger to persons.

6.1 Never start the engine without the battery securely connected.

6.2 Incorrect polarity of the supply voltage, e.g. through incorrect connection of battery or ignition coil, may lead to the destruction of the control unit.

6.3 Do not use a fast charger for starting the engine.

Use only a second 12 V battery and jump leads to provide aid for starting.

### Caution!

Owing to different requirements of vehicle manufacturers as regards electronic products, we recommend that 24 V batteries not be used as starting aids. Follow vehicle owner's manual.

6.4 Disconnect the battery from the vehicle electrical system before fast charging. Follow the operating instructions for the fast charger.



6.5 Do not disconnect the battery from the vehicle electrical system with the engine running.

6.6 Do not short-circuit ignition coil term. 1 to ground (e.g. to stop the engine). Ignition coil and possibly also Motronic control unit will be destroyed.

6.7 No battery + may be applied to ignition coil term. 1. Motronic control unit will be destroyed.

6.8 Never connect or disconnect wiring-harness plug of control unit with ignition on.

6.9 Remove the control unit at temperatures above 80°C (paint drying installation).

6.10 Remove the control unit before performing welding work (electric spot welding).

6.11 Before the compression test, remove plug of relay 2 (main relay). This prevents undesired injecting of the injection valves.





6.12 If installing an alarm system, follow the installation instructions for Motronic vehicles or Technical Bulletin "New Product" VDT-I-335/110.

It must be ensured that the alarm relay is not disturbed by stray fields (e.g. from H.T. ignition cables), thus triggering a false alarm.

6.13 The Motronic contains a high-energy ignition system which can be dangerous if live parts or terminals are touched (both on the primary as well as on the secondary side).

In this connection, we should like to point out that the VDE regulations, particularly VDE 0104/7.67, must be observed when testing or working on the ignition system.

Switch off the ignition whenever working on the ignition coil (switch off ignition/voltage source). Such work includes:

- Connecting of motortesters (timing light, dwell-tach tester, ignition oscilloscope etc).
- Replacing of parts of the ignition system (spark plug, ignition coil, high-voltage distributor, ignition cable etc).



If, while testing the ignition system or performing adjustment operations on the engine, it becomes necessary to switch on the ignition (switch on ignition/voltage source), the above-mentioned dangerous voltages occur over the entire system.

Therefore, the danger of accident exists not only on the individual components of the ignition system (such as high-voltage distributor, ignition coil, control unit and ignition harness), but also at the wiring harness (such as tachometer connection, diagnostic plug), at plug-in connections and on testers.



## 7. Trouble-shooting

It is essential to test the Motronic.

Among other things, the spark-advance angle which can be influenced by the knock control unit is tested using the universal test adapter.

The direct knock control trouble-shooting program for the experienced expert begins with the trouble-shooting chart according to customer complaints (fault symptoms) on Coordinate B 2.

Select the possible cause of the trouble from the trouble-shooting chart according to the complaint stated by the customer or which you yourself have determined.

The coordinate at the end of the cause column refers to the appropriate detailed trouble-shooting with corresponding test specification.

This is followed by detailed trouble-shooting which is best performed in the order given.

The sections are divided into testing with universal test adapter, ohmmeter, voltmeter and oscilloscope.



# Trouble-shooting chart

## Customer complaint (fault symptoms)

The causes listed in the table are covered by detailed trouble-shooting starting on Coordinate B 7 and when testing the Motronic.

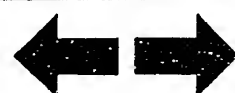
1. Engine fails to start or starts only with great difficulty
2. Engine starts but then dies
3. Uneven engine idle, idle speed incorrect
4. Poor throttle take-up
5. Engine missing under all operating conditions
6. Fuel consumption too high
7. No maximum engine power
8. CO concentration at idle too high

								Cause	Coordinates
•								Spark-advance signal absent	C 9
						•		Spark advance is not corrected (knock control unit defective)	C 15
			•			•		Knock control unit monitoring circuit responds (diagnosis)	C 15
						•		Full-load function absent (knock control unit defective)	D 7
				•				Loose contact in knock control unit	- - -
				•				Loose contact at plug-in connections	B 4
			•			•		Solenoid-operated valve not clicking (de-energized)	D 5
						•		Solenoid-operated valve constantly energized (injection pulses are cut off)	D 5
						•		Wastegate not opening (injection pulses are cut off)	- - -
			•			•		Throttle-valve potentiometer not supplying any voltage	C 13
			•			•		Engine-speed signal from Motronic/transmission control unit absent	B 6
			•			•		Knock sensor defective	B 19, C 15
•								No power supply to knock control unit	C 9
•	•	•	•	•	•	•	•	Knock control unit defective	- - -

**B2**

Trouble-shooting

BMW knock and charge-air pressure control



**B3**

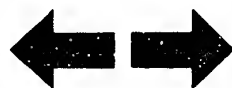
Trouble-shooting

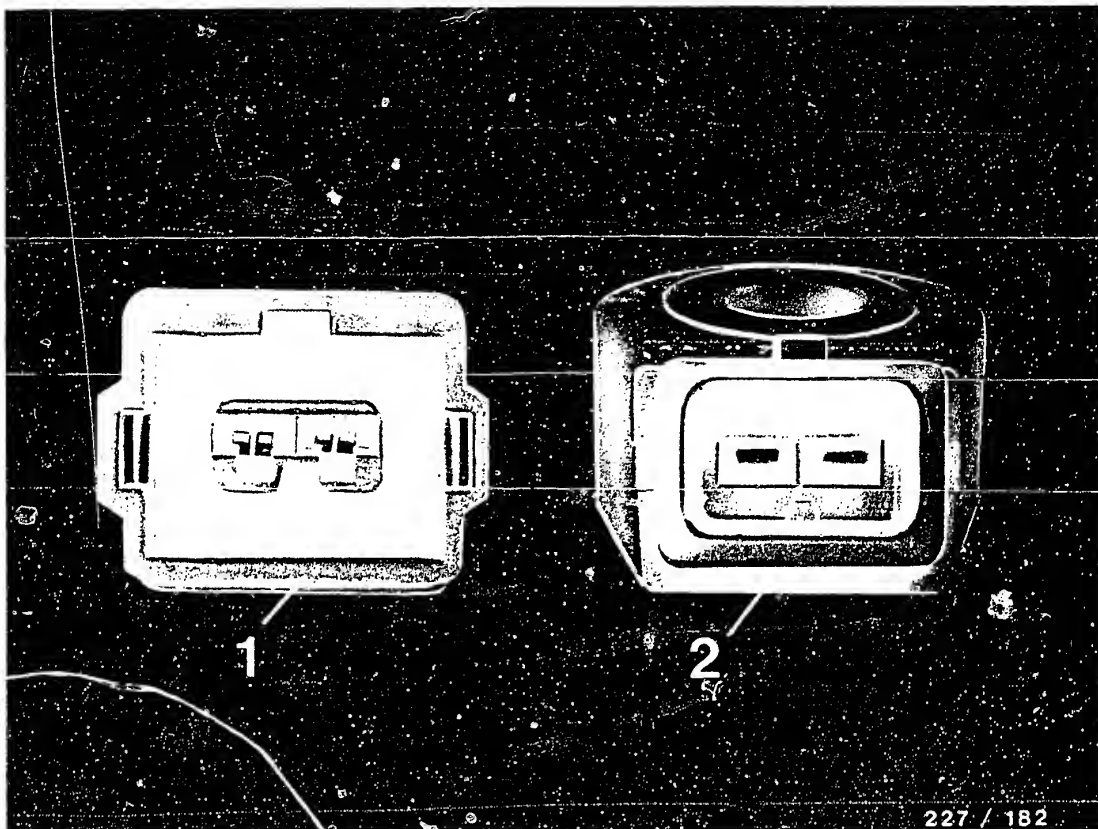
BMW knock and charge-air pressure control



## 7.1 General visual examination in engine compartment

- Check whether hoses of air-intake system and of fuel line system are properly attached, not kinked or damaged.  
Replace hoses if necessary.  
Eliminate leaks by using new seals or by retightening the connecting elements.
- Check electrical plug-in connections for corrosion, good contacting, loose contacts and proper seating.  
The spring contacts in the plug-in connections must be latched in and must not allow themselves to be pushed back.
- Is the hose connection between knock control unit and intake manifold correctly attached, leak-tight and not kinked?  
Pay particular attention to leadthrough at firewall and non-return valve.
- Pulse generator for cylinder recognition must be plugged onto H.T. ignition cable to cylinder 1 so that the moulded-on "tabs" point in the direction of the high-voltage distributor.





1 = Knock sensor plug

2 = Knock sensor socket

- Test plug-and-socket connection on knock sensor:

Remove knock sensor plug.

Check contacts of knock sensor plug and socket for oxidation. - Remove oxidation.

Reconnect knock sensor plug.

Fault remedied?





7.2 Test with universal test adapter ETT 018.01  
(0 684 101 801) and adapter lead (1 684 463 140)  
for transmission control

The knock control unit receives the information on engine speed and reference mark from the Motronic via the transmission plug. In the same way, the knock control unit issues the command "knock control active" to the Motronic via the transmission plug.

The three above-mentioned functions can be tested with the aid of the universal test adapter and the adapter lead for transmission control.

Connect universal test adapter to transmission wiring harness and Motronic/transmission control unit. Switch off ignition beforehand.

To make the measurements, connect to the test adapter a measuring instrument for measuring voltage and resistance (multimeter) as well as a motortester.

The program switch is used for selecting the individual test steps. The symbols "V" and " $\Omega$ " show the operator whether voltage or resistance is being measured. Some switch positions are also required for simulation with the engine running. By pressing the button it is possible with the control unit connected and with the engine running to simulate operating conditions. For example, with the engine running, by pressing button T 1 it is possible to make the control unit think that the kick-down switch has been actuated. The reaction of the control unit can then be evaluated on the multimeter.

If necessary, the circuit diagram can be used for trouble-shooting.



## Preparations for testing with the universal test adapter

Remove Motronic/transmission control unit and connect test adapter to transmission plug and control unit.

Installation position of control unit: In front-passenger footwell behind the right-hand side panel.

To remove the plug, press back the detent and hinge up the plug in the direction of the arrow and remove.

The control unit is fastened in position by 4 screws.

### Notes

To rule out confusion between the plugs of the different systems, a mechanical latching system has been introduced.

The "lug" (pivot point when opening and connecting the control unit) and the corresponding mount on the control unit have matching recesses and pins.

In addition to the mechanical latching system, the two 35-pin plugs are differently marked.

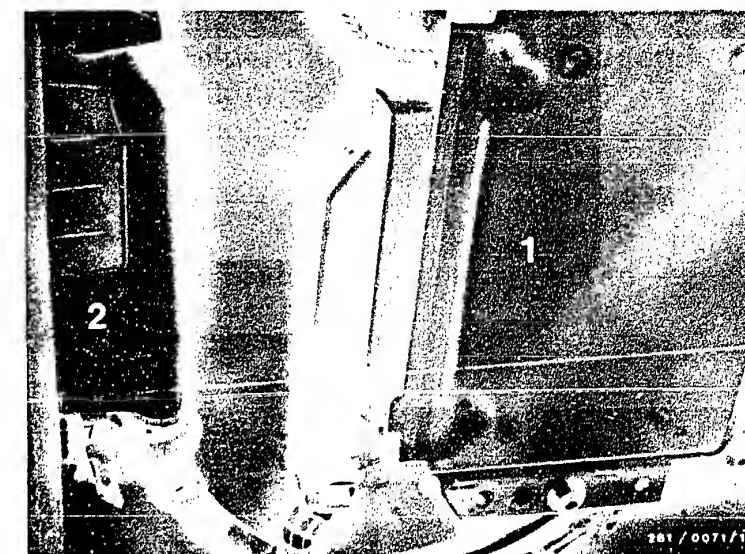
The transmission plug has a yellow cable binder, and the Motronic plug has a green cable binder.

The instruction "test lead" in the trouble-shooting means the following:

Test the lead for continuity, short circuit to ground and contact with other leads.  
Watch for wear and pinching.

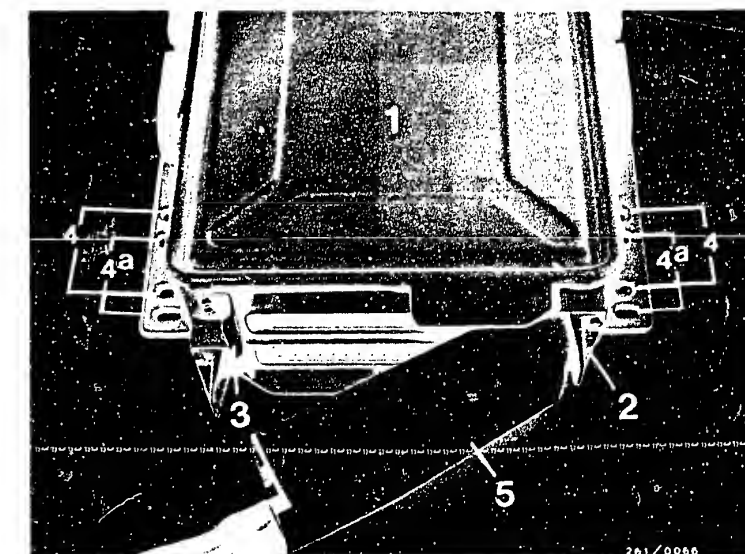
### Note:

In the following test steps a white border in the "Operation" column indicates which operation has to be changed compared to the preceding test step.



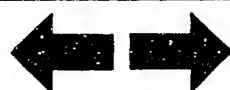
- 1 = Control unit
- 2 = ABS controller

- 1 = Control unit
- 2 = Lug
- 3 = Detent
- 4 = Mounting holes for 7 series
- 4a = Mounting holes for 6 series
- 5 = Transmission plug



**B7**

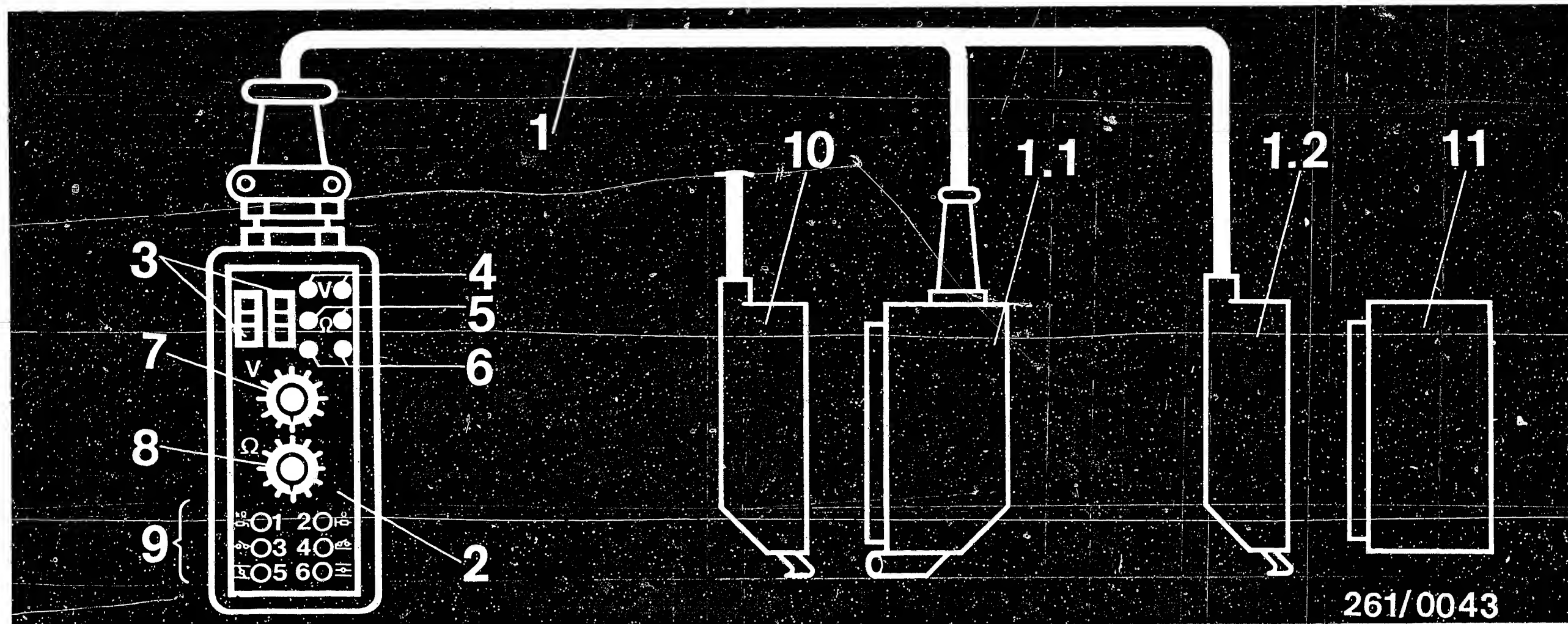
Test with universal test adapter  
BMW knock and charge-air pressure control



**B8**

Test with universal test adapter  
BMW knock and charge-air pressure control





261/0043

- |   |   |  |
|---|---|--|
| 1 = Adapter lead                                | 6 = Test sockets (for current measurement)              | Button 1 = Simulation of kick-down switch      |
| 1.1 = Connection to wiring harness              | 7 = Program switch "V"                                  | Button 2 = Unoccupied                          |
| 1.2 = Connection to control unit                | 8 = Program switch "Ω"                                  | Button 3 = Energization for transmission relay |
| 2 = Universal adapter (Part No.: 0 684 001 801) | 9 = Button panel for simulation of operating conditions | Button 4 = Unoccupied                          |
| 3 = Test wells (for motortester)                | 10 = Transmission wiring harness                        | Button 5 = Unoccupied                          |
| 4 = Test sockets (for voltage measurement)      | 11 = Control unit                                       | Button 6 = Unoccupied                          |
| 5 = Test sockets (for resistance measurement)   |   |  |

Universal test adapter with adapter lead for transmission control

**B9**

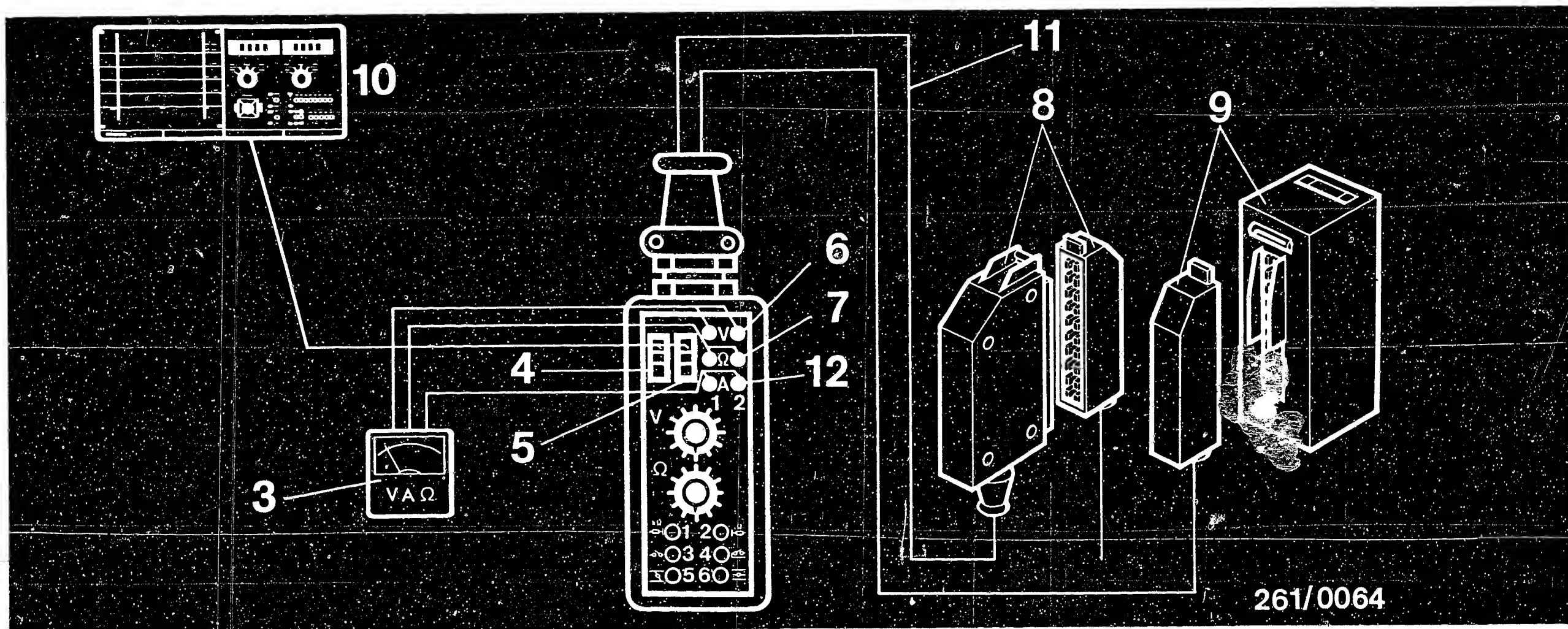
Test with universal test adapter  
BMW knock and charge-air pressure control



**B10**

Test with universal test adapter  
BMW knock and charge-air pressure control





- 3 = Multimeter
- 4 = Red connection socket (test well) for red clip of motortester
- 5 = Black connection socket (test well) for black clip of motortester
- 6 = Connection of voltmeter to V sockets (red = +, black = ground/negative)

- 7 = Connection of ohmmeter to Ω sockets (blue)
- 8 = Connection to Motronic wiring harness
- 9 = Connection to Motronic control unit
- 10 = Motortester
- 11 = Adapter lead for Motronic
- 12 = Connection of ammeter (black sockets, 1 = negative, 2 = positive)

Connection diagram for universal test adapter

**B11**

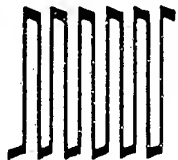
Test with universal test adapter  
BMW knock and charge-air pressure control



**B12**

Test with universal test adapter  
BMW Knock and charge-air pressure control



Test step 1 - connect Motronic/transmission control unit and knock control unit			
Operation		Reading	Testing
Program switch "V" at position	19	on oscilloscope 	<u>Component:</u> Motronic/transmission control unit
Program switch "Ω" at position	15		
<u>Measuring equipment:</u> Motortester, oscilloscope		Lever in center position, button V/kV pressed.	<u>Operation:</u> Engine-speed signal at terminal 31 and ground
<u>Measuring range:</u> Special input			
<u>Connection:</u> Test wells: Red clip to red well, black clip to black well		If reading O.K., continue testing with <u>next test step</u> .	<u>Malfunction:</u> No signal or signal incorrect
<u>Operation in vehicle:</u> Start engine			

### Trouble-shooting

If test of Motronic part has been successfully completed using universal test adapter according to microcard SIS-BMW-04/E21, then replace Motronic/transmission control unit.

**B 13**

Test with universal test adapter  
BMW knock and charge-air pressure control




**B 14**

Test with universal test adapter  
BMW knock and charge-air pressure control





# Test step 2 - connect Motronic/transmission control unit and knock control unit

<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch "V"</u> at position	20	on oscilloscope 	<u>Component:</u> Motronic/transmission control unit
<u>Program switch "Ω"</u> at position	15		
<u>Measuring equipment:</u> Motortester, oscilloscope		Lever in center position, button V/kV pressed	<u>Operation:</u> Reference-mark signal at terminal 32 and ground
<u>Measuring range:</u> Special input			
<u>Connection:</u> Test wells: Red clip to red well black clip to black well		If reading O.K., continue testing with <u>next test step.</u>	<u>Malfunction:</u> No signal or signal incorrect
<u>Operation in vehicle:</u> Shift gear to neutral and start engine.			

## Trouble-shooting

If test of Motronic part has been successfully completed using universal test adapter according to microcard SIS-BMW-04/E21, then replace Motronic/transmission control unit.

**B 15**

Test with universal test adapter  
BMW knock and charge-air pressure control



**B 16**

Test with universal test adapter  
BMW knock and charge-air pressure control





Test step 3 - switch off ignition and remove transmission plug from control unit.  
Connect knock control unit.

<u>Operation</u>		<u>Reading</u>	<u>Testing</u>
<u>Program switch "V"</u> <u>at position</u>	21	on voltmeter <u>3...5 V</u>	<u>Component:</u> Knock control unit
<u>Program switch "Ω"</u> <u>at position</u>	15	(Note: Measured directly between terminal 21 and ground without test adapter, the test specification rises to 4...6 V)	
<u>Measuring equipment:</u> Voltmeter			<u>Operation:</u> Lead and resistance from knock control unit term. 21 to ground
<u>Measuring range:</u> 15 V			
<u>Connection:</u> Test sockets (red = + black = ground)	V		<u>Malfunction:</u> Resistance less than 1 kΩ or greater than 9 kΩ
<u>Operation in vehicle:</u> Switch on ignition			

Trouble- shooting:

- Test lead from 35-pin transmission plug term. 35 to knock control unit term. 21 including 4-pin intermediate connector term. 4.
- Test plug-in connections for loose contacts and contact resistances.
- Test ground leads from knock control unit term. 12 and term. 14 as well as ground terminal for contact resistance, open circuit and proper contact.
- Replace knock control unit.

**B 17**

Test with universal test adapter  
BMW knock and charge-air pressure control



**B 18**

Test with universal test adapter  
BMW knock and charge-air pressure control



### 7.3 Resistance measurements

Switch off ignition. Remove 25-pin plug (multiple plug) from knock control unit. Perform resistance measurements on multiple plug using suitable test prods. Do not damage spring contacts.

#### Internal resistance of knock sensors:

Measure with ohmmeter (0 to 10 k $\Omega$ ) between term. 6 and term. 10 (knock sensor 2) as well as term. 9 and term. 10 (knock sensor 1).

Test specification in both cases

270 ... 330 k $\Omega$

Resistance correct?

No

If test specification less than 270 k $\Omega$ , check whether screen (at term. 10) is incorrectly connected to term. 6 or term. 9.

Repeat resistance measurement directly at the knock sensors.

Knock sensor 1 is installed between cylinders 1 and 2, knock sensor 2 between cylinders 5 and 6.

If knock sensor O.K., check plug-in connections for corrosion, proper seating of spring contacts, and check leads for open circuit.

If knock sensor defective, replace.

Do not use a washer, spring lock washer or similar for mounting the knock sensor.

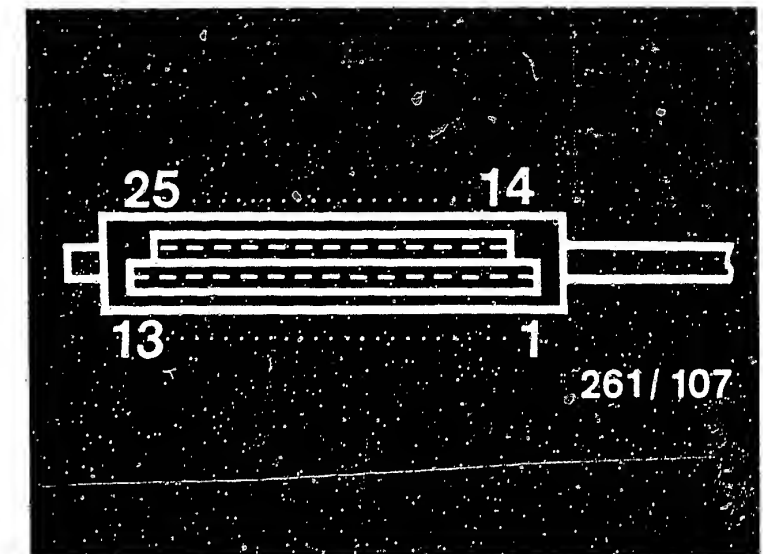
Secure screw only with locking paint.

Tightening torque (important):

11 ... 15 Nm

Yes

Continued on B21/B22



Top view of multiple plug

1 = Knock sensor



**B19**

Resistance measurements

BMW knock and charge-air pressure control



**B20**

Resistance measurements

BMW knock and charge-air pressure control



## Resistance measurements (continued)

Yes

### Throttle-valve potentiometer:

1. Measure total resistance using ohmmeter (0 to 10 k $\Omega$ ) between term. 11 and term. 20.

Test specification:  
3.2...4.8 k $\Omega$

Resistance correct?

No

Repeat resistance measurement directly at throttle-valve potentiometer.

To do this, remove rubber cap and undo plug-in connection.

Top view of potentiometer plug:

Pin 1 = + (term. 11)

Receptacle 2 = wiper (term. 8)

Receptacle 3 = - (term. 20)

If potentiometer O.K., test plug-in connection and leads for open circuit.

If potentiometer defective, replace.

Adjust new potentiometer according to Section 7.5.

Yes

2. Measure resistance between wiper term. 8 and term. 20.

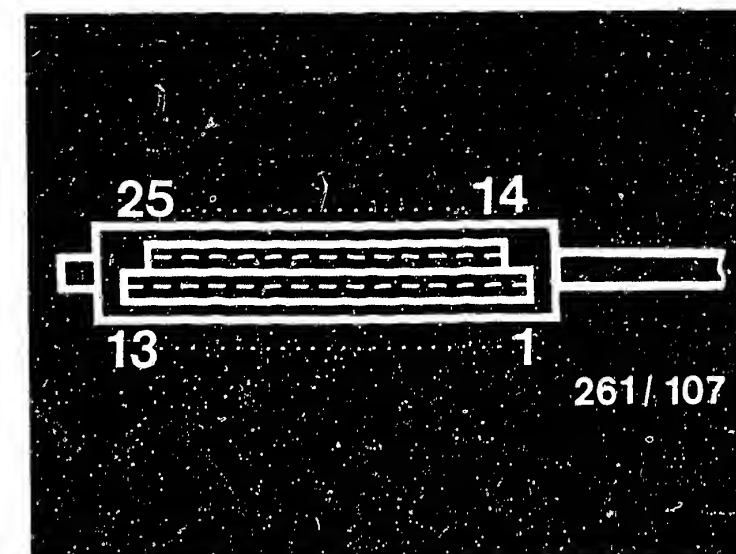
Test specification:  
200...1000  $\Omega$

Resistance correct?

No

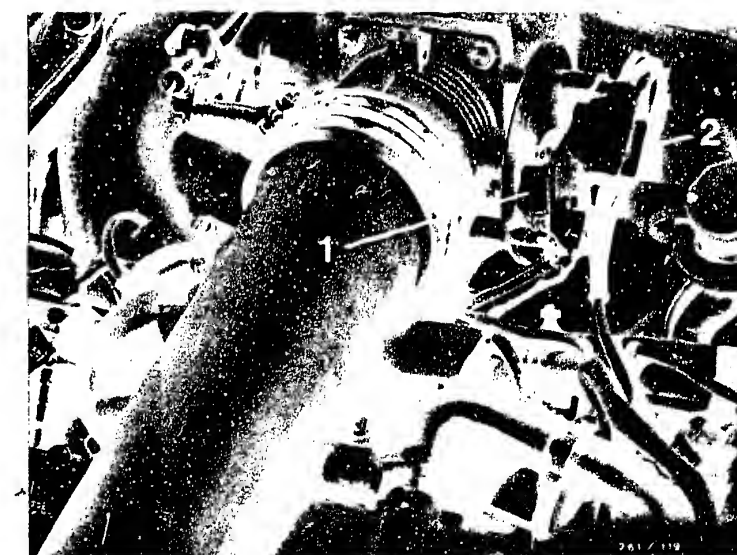
Yes

Continued on B23/B24



Top view of multiple plug

1 = Microswitch  
2 = Potentiometer



**B21**

Resistance measurements

BMW knock and charge-air pressure control



**B22**

Resistance measurements

BMW knock and charge-air pressure control



## Resistance measurements (continued)

Yes

### Pulse generator for cylinder recognition

Measure internal resistance with ohmmeter (0 to 10 k $\Omega$ ) between term. 18 and term. 19.

Test specification:  
approx. 0  $\Omega$

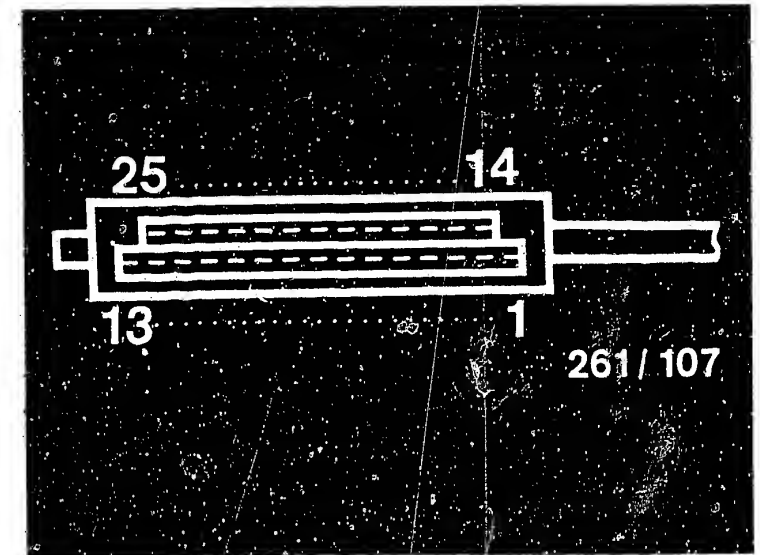
Resistance correct?

Yes

No

Repeat resistance measurement directly at pulse generator.  
If pulse generator O.K., test plug-in connection and leads for open circuit.  
If pulse generator defective - replace.  
When installing, make sure that the pulse generator is slipped over the H.T. ignition cable of cylinder 1 between high-voltage distributor and spark plug. Mark (see picture, arrow) must point toward high-voltage distributor.

Continued to C1/C2



Top view of multiple plug

1 = Pulse generator  
Arrow = Mark



**B23**

Resistance measurements  
BMW knock and charge-air pressure control



**B24**

Resistance measurements  
BMW knock and charge-air pressure control



Resistance measurements (continued)

Yes

Ground connections  
Test measurements with ohmmeter (0 to 10 k $\Omega$ ) between term. 12 and ground as well as term. 14 and ground.  
Test specification max. 5  $\Omega$  in either case  
Resistance correct?

No

Ground leads of knock control lead to the ground terminals of the Motronic.  
The ground terminals are mounted directly on the negative pole of the battery.  
Test terminals for corrosion, security and loose contact.  
Test leads for open circuit.

Yes

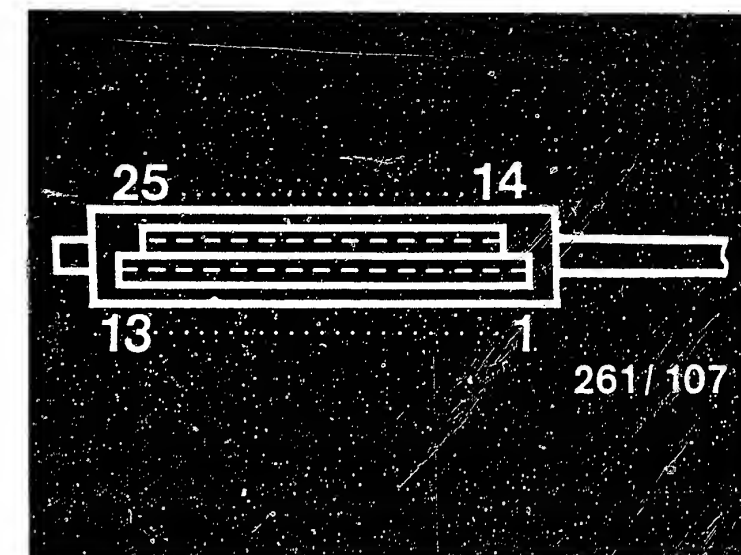
Leads to Motronic plug (35-pin)  
Using ohmmeter (0 to 10 k $\Omega$ ), test the following leads for continuity: Measurements between knock control unit plug (25-pin) and Motronic plug (35-pin):  
Term.13 and term.3 (Motronic)  
Term.16 and term.24 (Motronic)  
Term.24 and term.21 (Motronic)  
Test specification 0  $\Omega$  in each case  
Resistance correct?

No

Test plug-in connections (spring contacts) for open circuit, loose contact and corrosion. Spring contacts must not allow themselves to be pushed back.  
Check leads for open circuit, wear and pinching.

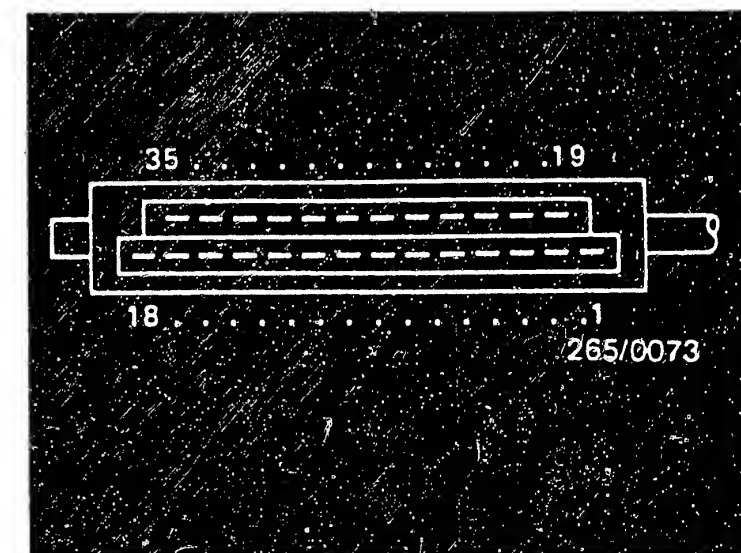
Yes

Continued on C3/C4



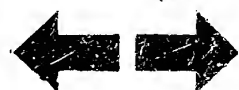
Top view of multiple plug of knock control unit

Top view of multiple plug (35-pin)



C1

Resistance measurements  
BMW knock and charge-air pressure control



C2

Resistance measurements  
BMW knock and charge-air pressure control



## Resistance measurements (continued)

Yes

Leads to transmission plug  
(35-pin)

Using ohmmeter (0 to 10 k $\Omega$ ),  
test the following leads for  
continuity:

Measurements between knock  
control unit plug (25-pin)  
and transmission plug (35-  
pin);

Term. 5 and term. 32 (trans-  
mission)

Term. 7 and term. 31 (trans-  
mission)

Term. 21 and term. 35 (trans-  
mission)

Test specification 0  $\Omega$   
in each case

Resistance correct?

No

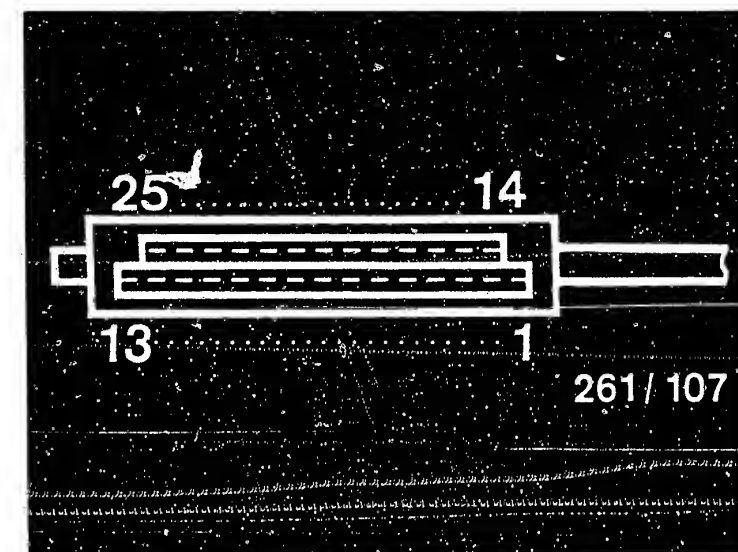
Test plug-in connections (spring contacts)  
and 4-pin intermediate connector (near  
Motronic/transmission control unit) for  
open circuit, loose contact and corrosion.

Spring contacts must not allow themselves  
to be pushed back.

Check leads for open circuit, wear and  
pinching.

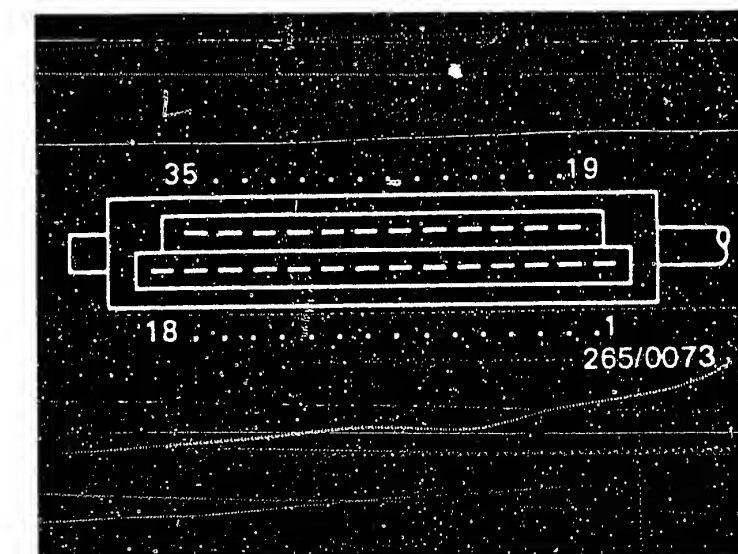
Yes

Continued on C5/C6



Top view of multiple plug  
(25-pin)

Top view of multiple plug  
(35-pin)



**C3**

Resistance measurements  
BMW knock and charge-air pressure control



**C4**

Resistance measurements  
BMW knock and charge-air pressure control





## Resistance measurements (continued)

Test screens of knock sensors, of throttle-valve potentiometer and of pulse generator.

Perform following measurements with ohmmeter (measuring range 1 M $\Omega$ ):

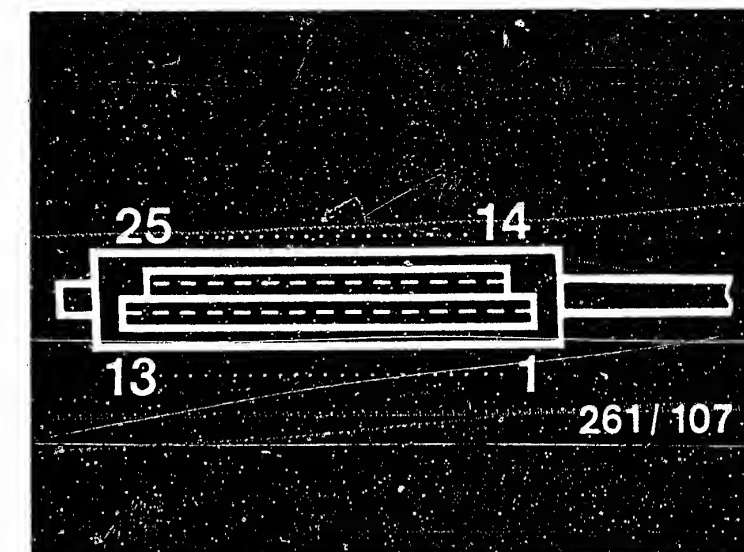
Between term. 10 and term. 12,  
between term. 20 and term. 12,  
between term. 18 and term. 12.

Test specification greater than  
100 k  $\Omega$   
in each case.

Resistance correct?

No

Resistance less than 100 k $\Omega$ :  
For term. 10 and term. 20,  
test appropriate lead for wear  
and pinching with ground.  
For term. 18, there is a con-  
ducting connection between  
pulse generator lead and  
screen. Repair lead, or re-  
place wiring harness.



Top view of multiple plug

Continued on C7/C8

**C5**

Resistance measurements  
BMW knock and charge-air pressure control



**C6**

Resistance measurements  
BMW knock and charge-air pressure control



#### 7.4 Voltage measurements

Switch off ignition.  
Remove 25-pin multiple plug from  
knock control unit.  
Perform voltage measurements at multiple  
plug using suitable test prods.  
Do not damage spring contacts.

##### Supply voltage for knock control unit:

Connect voltmeter to  
term 25 (+) and term. 12 (-).

Switch on ignition.

Test specification: 10...15 V

Voltage present?

Yes

Spark-advance signal present at term. 24 ?

Yes

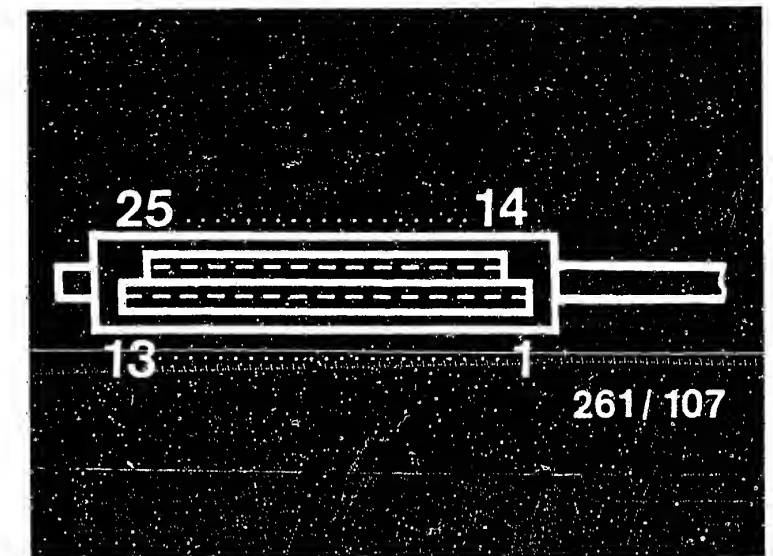
No

Test plug-in connections with lead  
to relay 2 (main relay of Motronic)  
term. 87.  
Measure voltage at relay 2 term.  
87.  
If no voltage, replace relay 2.

No

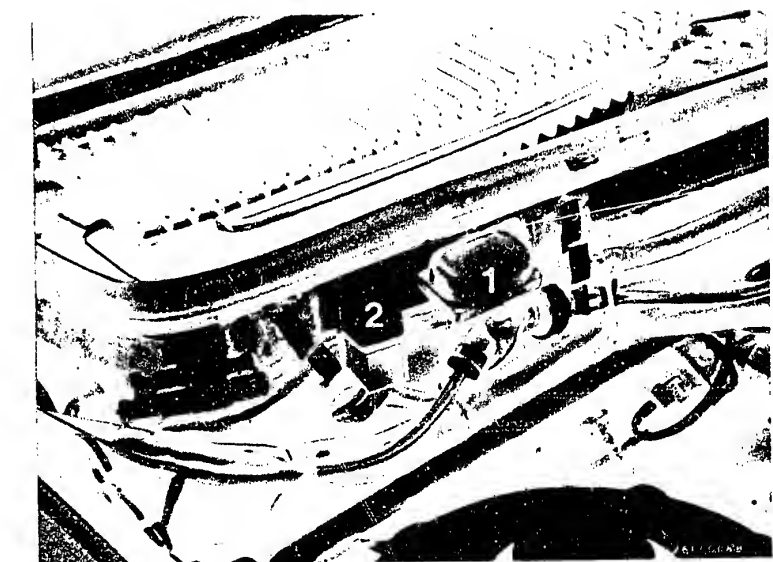
Replace knock control unit.

Continued on C9/C10



Top view of multiple plug

1 = Altitude sensor  
2 = Relay 2 (main relay)



**C7**

Voltage measurements  
BMW knock and charge-air pressure control



**C8**

Voltage measurements  
BMW knock and charge-air pressure control



## Voltage measurements (continued)

### Solenoid-operated valve

Connect voltmeter to

term. 2 (+) and term. 12 (-).

Switch on ignition.

Test specification: 10 ... 15 V

Voltage present?

No

Test lead from term. 2 to solenoid-operated valve and from solenoid-operated valve to term. B + for open circuit.

Test plug-in connections for corrosion, good contacting and open circuit.

Yes

### Starting signal from term. 50

Connect voltmeter to

term. 17 (+) and term. 12 (-).

Switch on ignition and operate starting motor.

Test specification: 8 ... 15 V

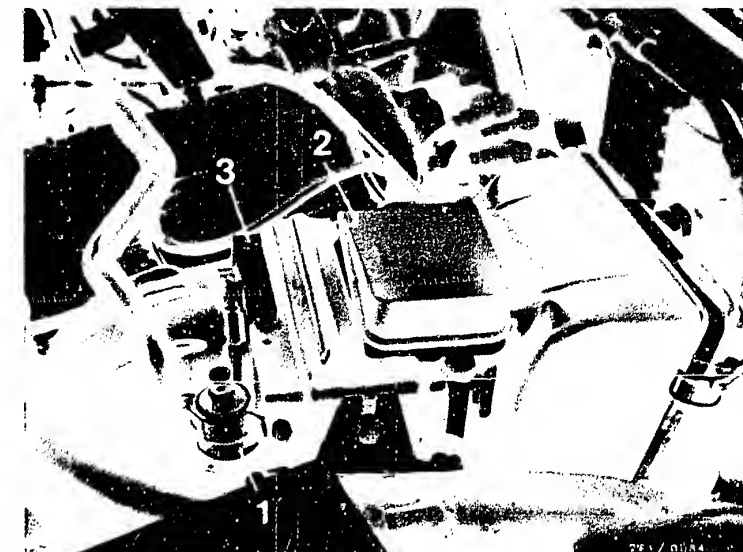
Voltage present?

No

Test lead to starting motor term. 50 for open circuit.

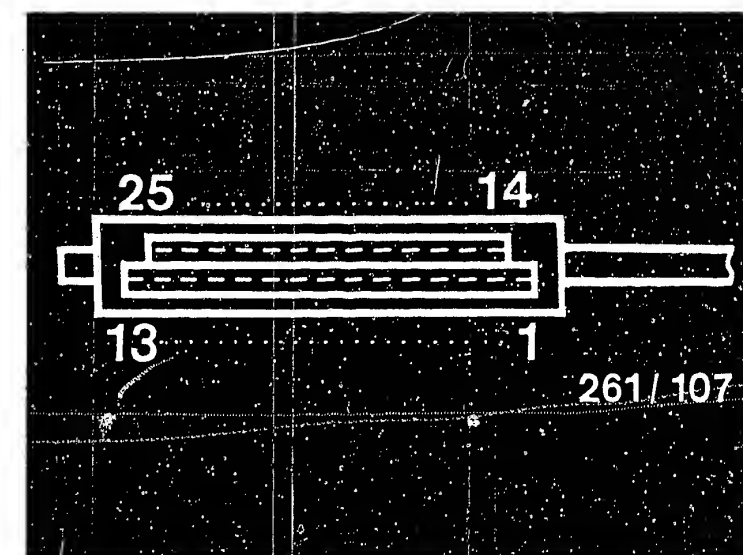
Test connections for corrosion, good contacting and open circuit.

Continued on C11/C12



- 1 = Solenoid-operated valve
- 2 = Air-flow sensor
- 3 = Idle-mixture-adjusting screw

Top view of multiple plug



**C9**

Voltage measurements

BMW knock and charge-air pressure control



**C10**

Voltage measurements

BMW knock and charge-air pressure control



## 7.5 Throttle-valve potentiometer - voltage test and adjustment

Measure supply voltage for throttle-valve potentiometer.

Switch off ignition.  
Remove plug from knock control unit and remove cover from plug.  
Plug plug back onto knock control unit.  
Switch on ignition.  
Using suitable test prods, measure voltage at terminals 11 (+) and 20 (-).

Test specification: 4 ... 5 V

Voltage present?

No

Replace knock control unit.

Measure wiper voltage of throttle-valve potentiometer.

Switch on ignition.  
Hold test prods against terminals 8 (+) and 20 (-) of knock control unit plug.  
Throttle valve at idle stop.

Test specification: 0.65 ... 0.75 V

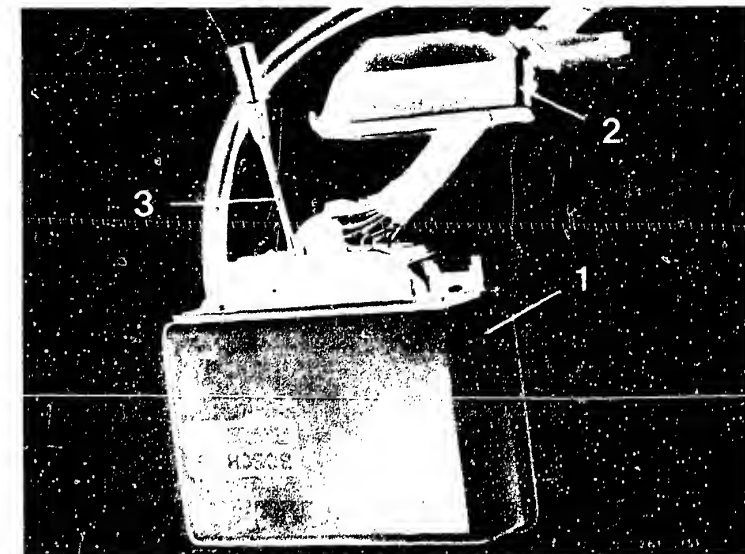
Voltage present?

No

Check measurement:

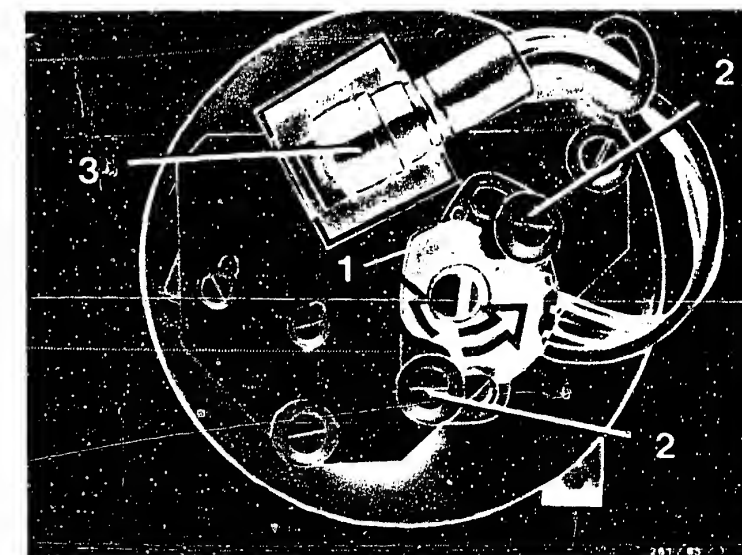
Bring throttle valve against full-load stop.  
Voltage rises to 3.8...4.8 V.

Adjusting the throttle-valve potentiometer:  
Loosen fastening screws slightly. Turn potentiometer until wiper voltage is 0.7 V. Make sure that the throttle valve is at the idle stop during testing. Tighten fastening screws. Check wiper voltage at full load:  
3.8...4.8 V (is not adjustable)



1 = Knock control unit  
2 = Cover  
3 = Test prod

1 = Potentiometer  
2 = Fastening screws  
3 = 3-pin connector



**C11**

Testing and adjusting throttle-valve pot.  
BMW knock and charge-air pressure control



**C12**

Testing and adjusting throttle-valve pot.  
BMW knock and charge-air pressure control



## 7.6 Diagnostic signal

Important components and functions of the knock control are continuously monitored by the knock control unit itself:

Battery voltage, throttle-valve potentiometer, charge-air pressure, knock sensors and the evaluation circuit of the knock control unit.

If the safety program detects a fault, the solenoid-operated valve is no longer actuated and the ignition timing is retarded.

The effects on driveability are:

Poor acceleration and no maximum engine power.

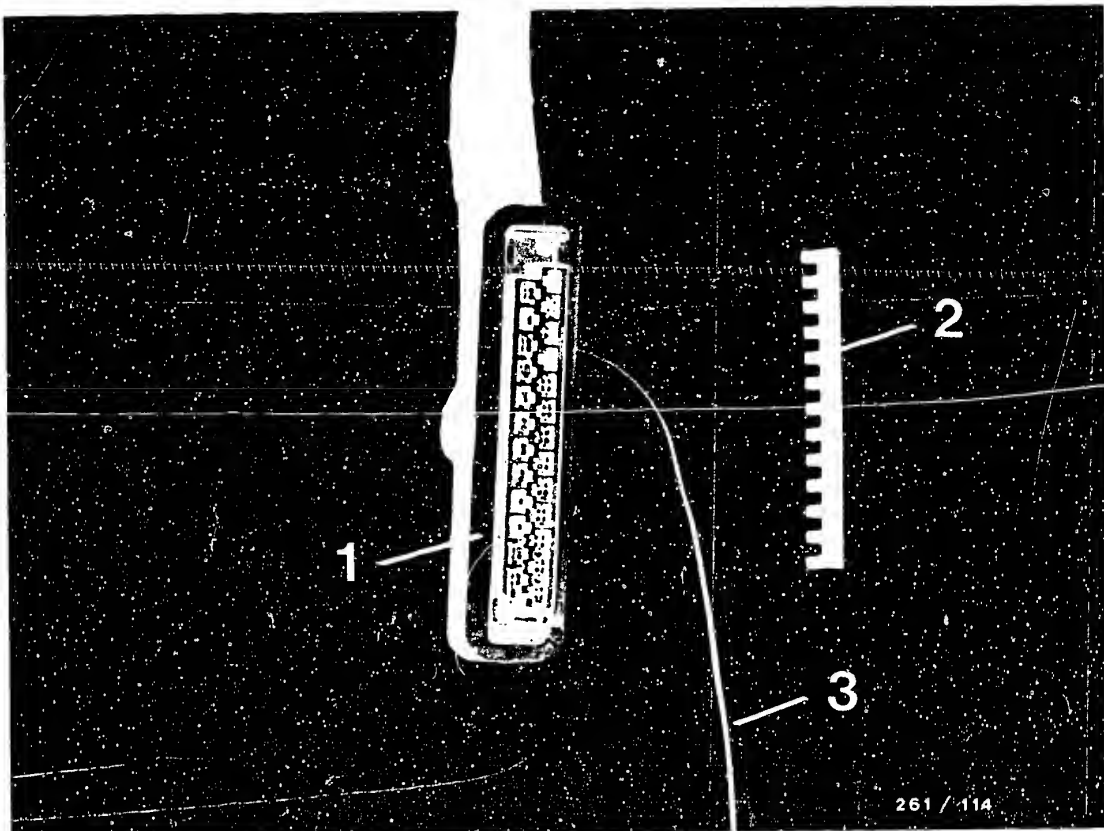
Low battery voltage and a defective throttle-valve potentiometer lead to the responding of the safety circuit. This can be made visible on the oscilloscope.

These two functions are not dealt with here since they have already been tested in Section 7.4.

Described below are the dynamic tests for knock sensors, knock control unit and charge-air pressure function of knock control unit.

If there is a fault, a diagnostic signal is output.





1 = Plug

2 = "Comb"

3 = Test lead

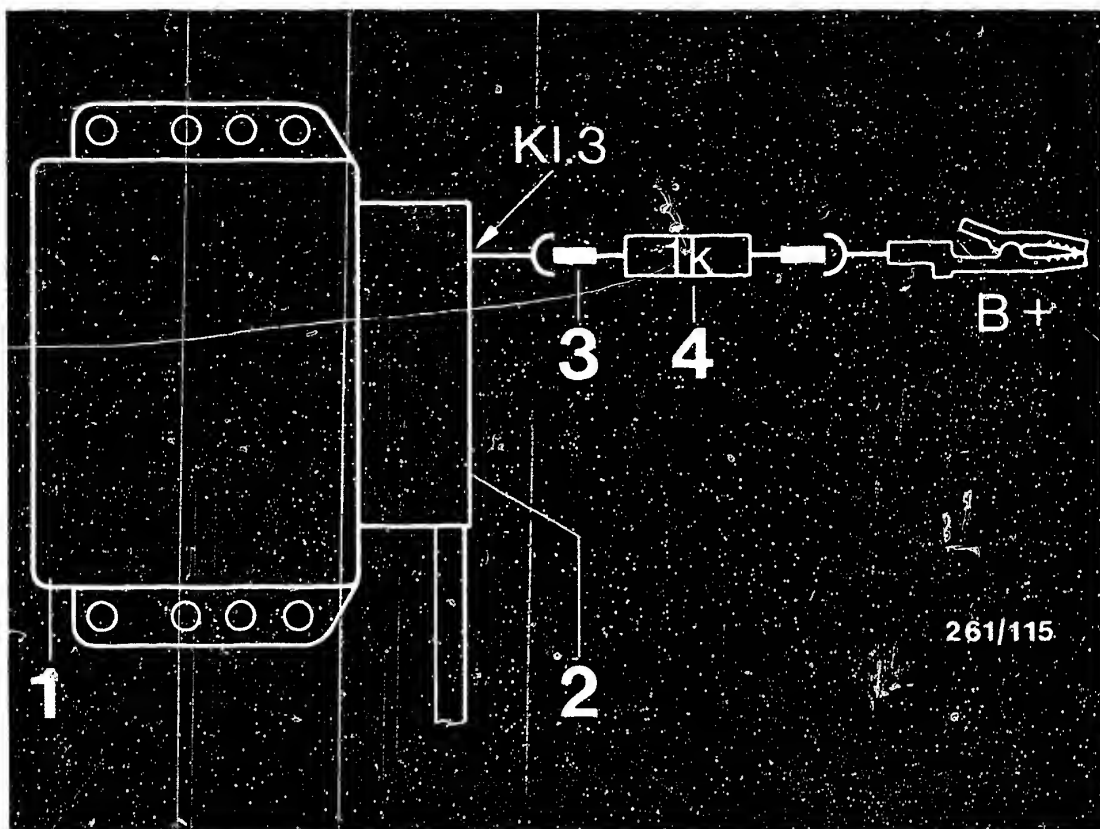
#### 7.6.1 Test for evaluation circuit in knock control unit

Switch off ignition.

Remove cover from 25-pin plug; push back rubber sleeve, loosen screw and remove cover.

Remove "comb" and sealing rubber from plug, and insert test lead (spring contact) into term. 3.

Beforehand, press back lug on spring contact so that the spring contact can easily be removed again after testing.



- 1 = Knock control unit
- 2 = Plug
- 3 = Connection - red clip of oscilloscope
- 4 = Test lead with resistor

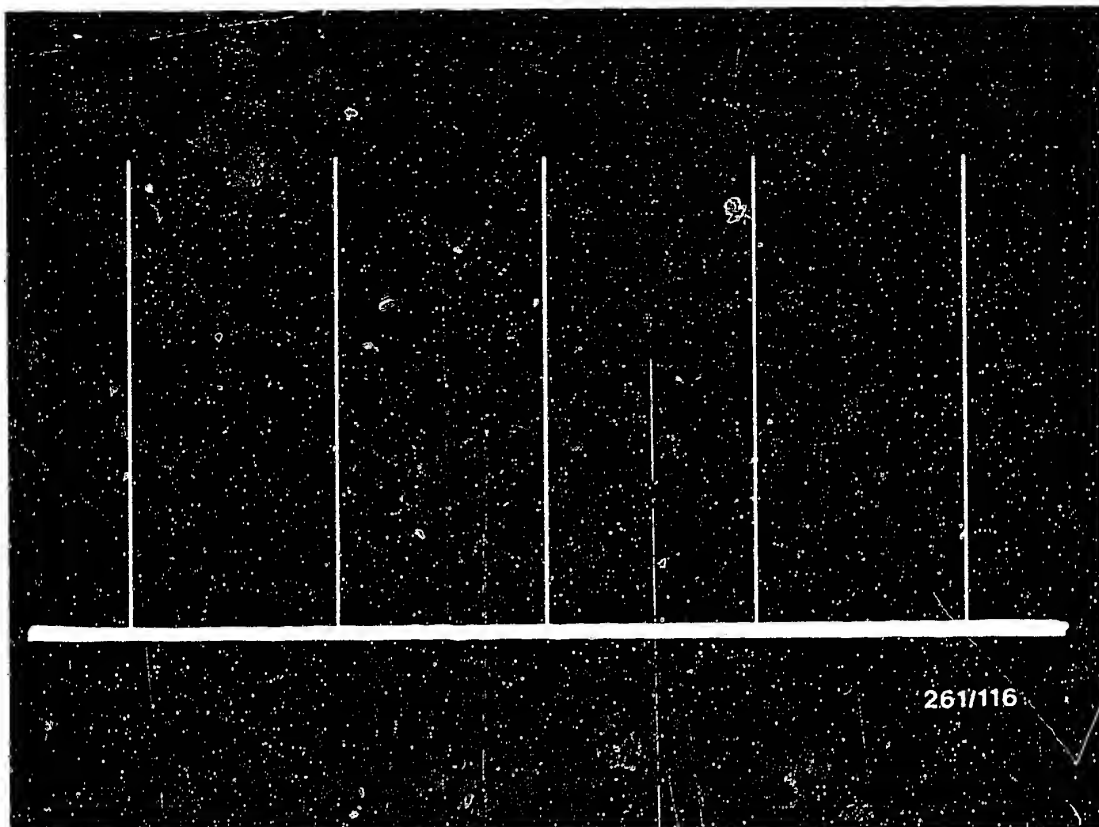
Re-insert "comb" and plug 25-pin plug onto knock control units.

Connect test lead (with 1 k $\Omega$  resistor) to battery positive.

Connect red clip of special input of ignition oscilloscope to test lead before resistor (term. 3).  
Black clip to ground.

Set oscilloscope to special input and set maximum sensitivity.





Diagnostic signal in case of fault.

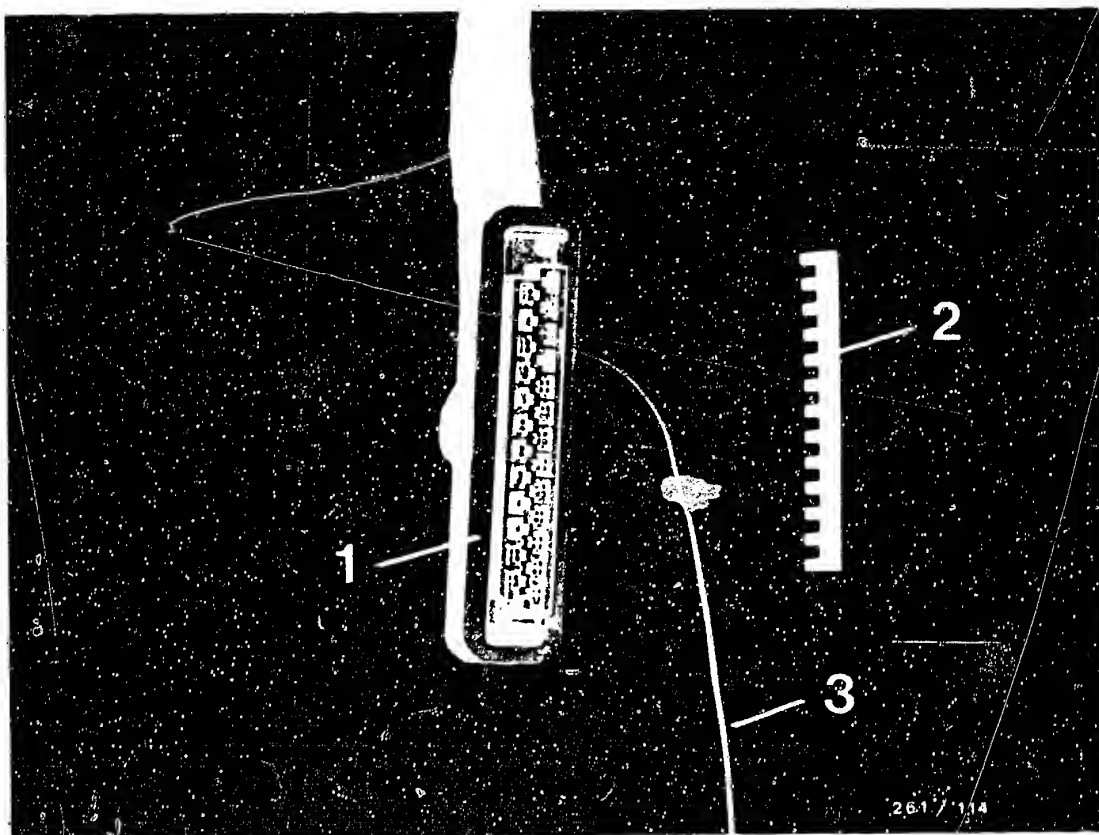
Run engine at idle speed.

Watch signals on oscilloscope:

If there appear the spike pulses shown above, then replace knock control unit.

(If O.K.: Horizontal line on screen).





1 = Plug

2 = "Comb"

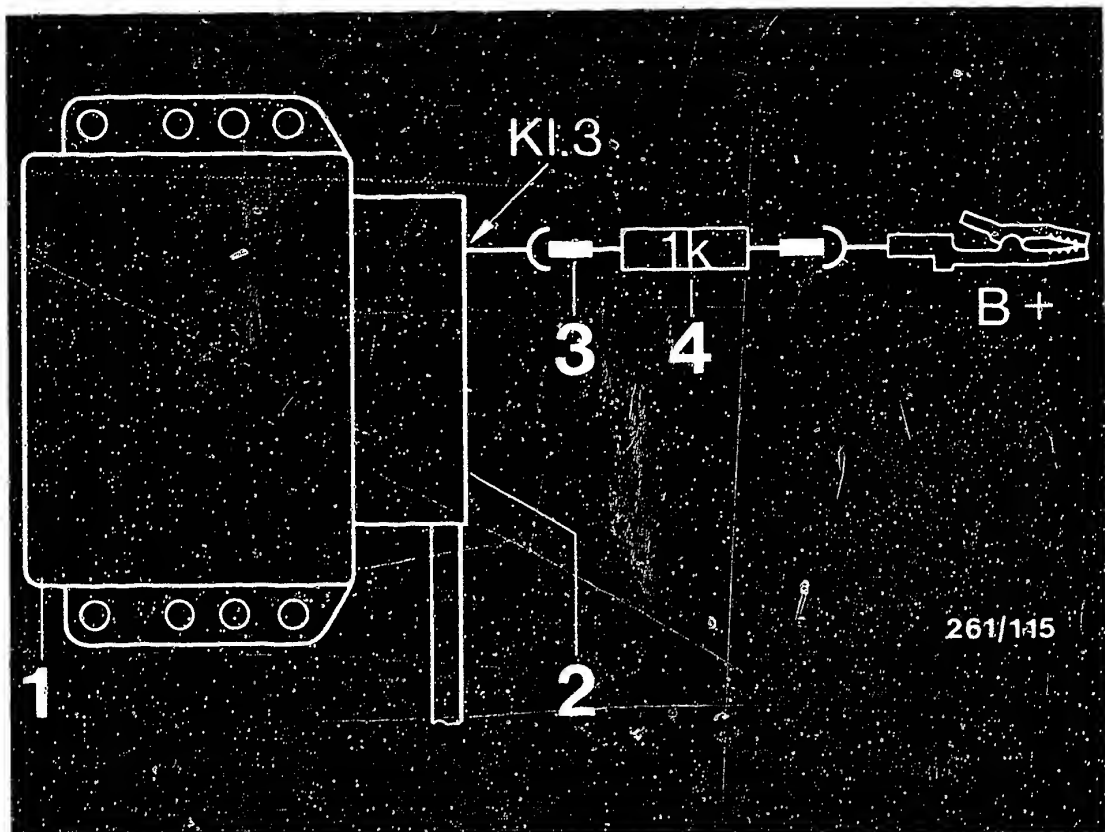
3 = Test lead

### 7.6.2 Testing the knock sensors (with oscilloscope)

Switch off ignition.

Remove cover from 25-pin plug; push back rubber sleeve, loosen screw and remove cover.

Remove "comb" and sealing rubber from plug, and insert test lead (spring contact) into term. 3. Beforehand, press back lug on spring contact so that the spring contact can easily be removed again after testing.



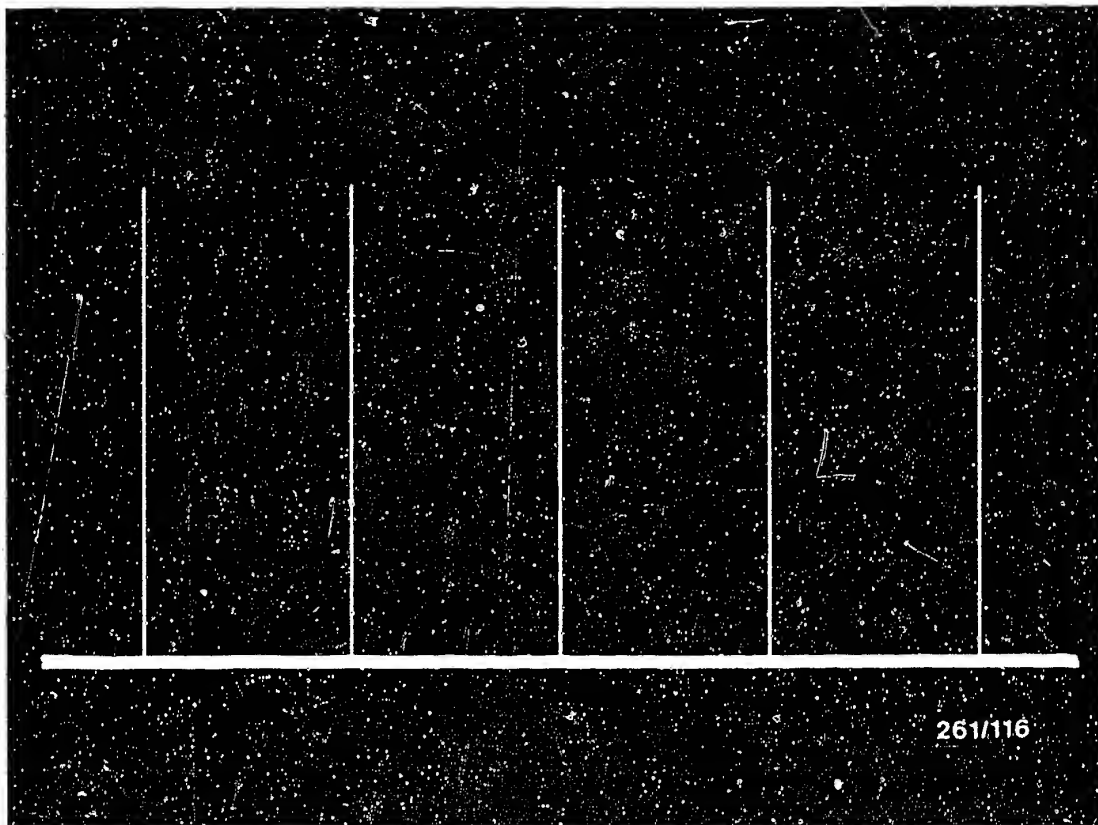
- 1 = Knock control unit
- 2 = Plug
- 3 = Connection - red clip of oscilloscope
- 4 = Test lead with resistor

Re-insert "comb" and plug 25-pin plug onto knock control unit.

Connect test lead (with 1 k $\Omega$  resistor) to battery positive.

Connect red clip of special input of ignition oscilloscope to test lead before resistor (term. 3).  
Black clip to ground.

Set oscilloscope to special input and set maximum sensitivity.



Diagnostic signal in case of fault.

Operate engine at  $3200 \text{ min}^{-1}$  for at least 30 seconds.

Observe signals on oscilloscope:

If there appear the spike pulses shown above, then one or both knock sensors are defective.





1 = Knock sensor between cylinders 1 and 2  
(2nd knock sensor is between cylinders 5 and 6)

Testing the knock sensors (internal resistance)

Remove plug from knock sensors and test sensors with ohmmeter.

Resistance: 270 ... 330 k $\Omega$

Test leads from 25-pin plug term. 6, term. 9 and term. 10 to knock sensors including plug-in connections.

Knock sensor leads must be screened and must be laid separate from H.T. leads.



1 = Knock sensor

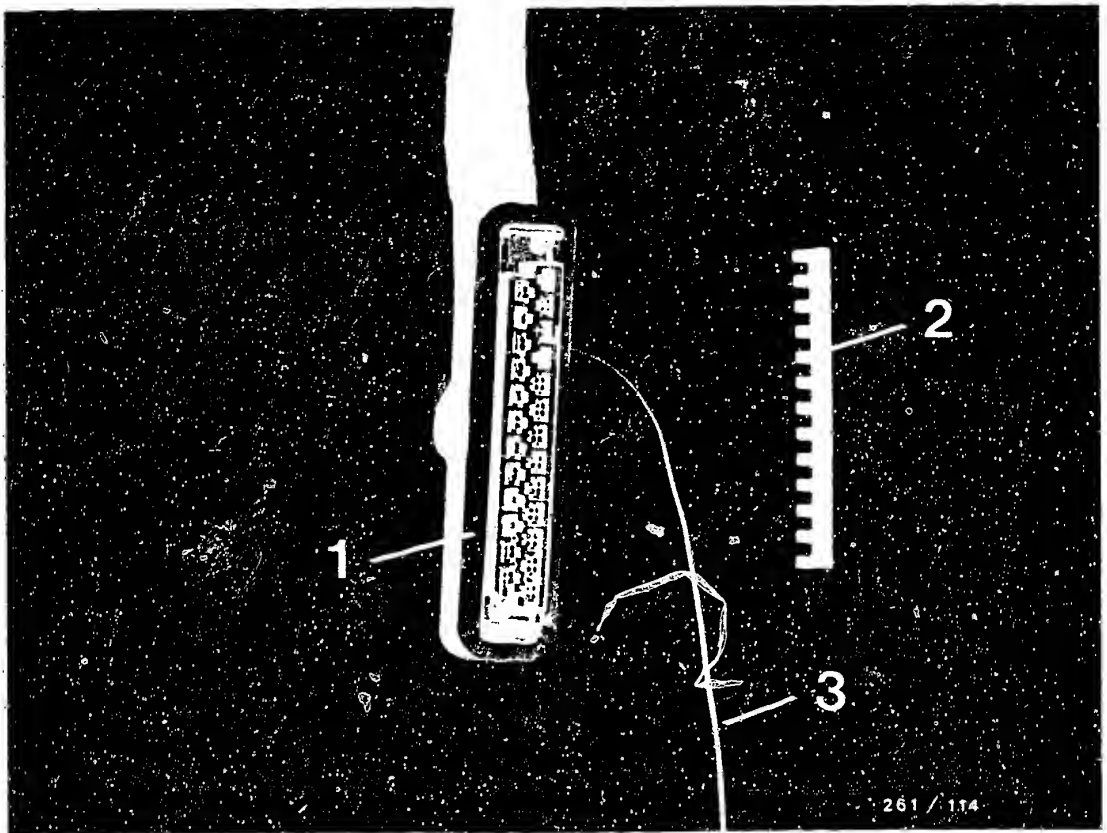
### Replacing the knock sensors

Mount knock sensor fastening screw without washer, spring lock washer, tooth lock washer or similar.

Secure fastening screw only with locking paint.

Observe tightening torque for screw: 11...15 Nm.





1 = Plug

2 = "Comb"

3 = Test lead

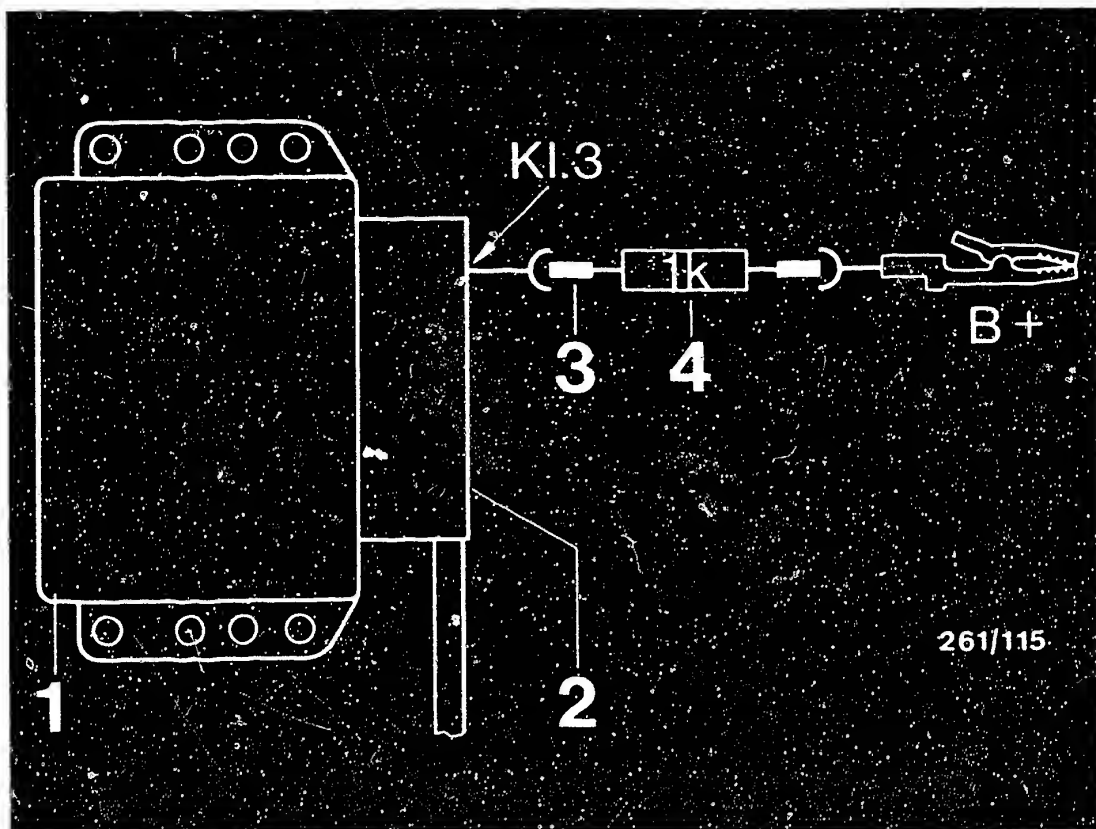
### 7.6.3 Testing the charge-air pressure function of knock control unit

Switch off ignition.

Remove cover from 25-pin plug; push back rubber sleeve, loosen screw and remove cover.

Remove "comb" and sealing rubber from plug, and insert test lead (spring contact) into term. 3.

Beforehand, press back lug on spring contact so that the spring contact can easily be removed again after testing.



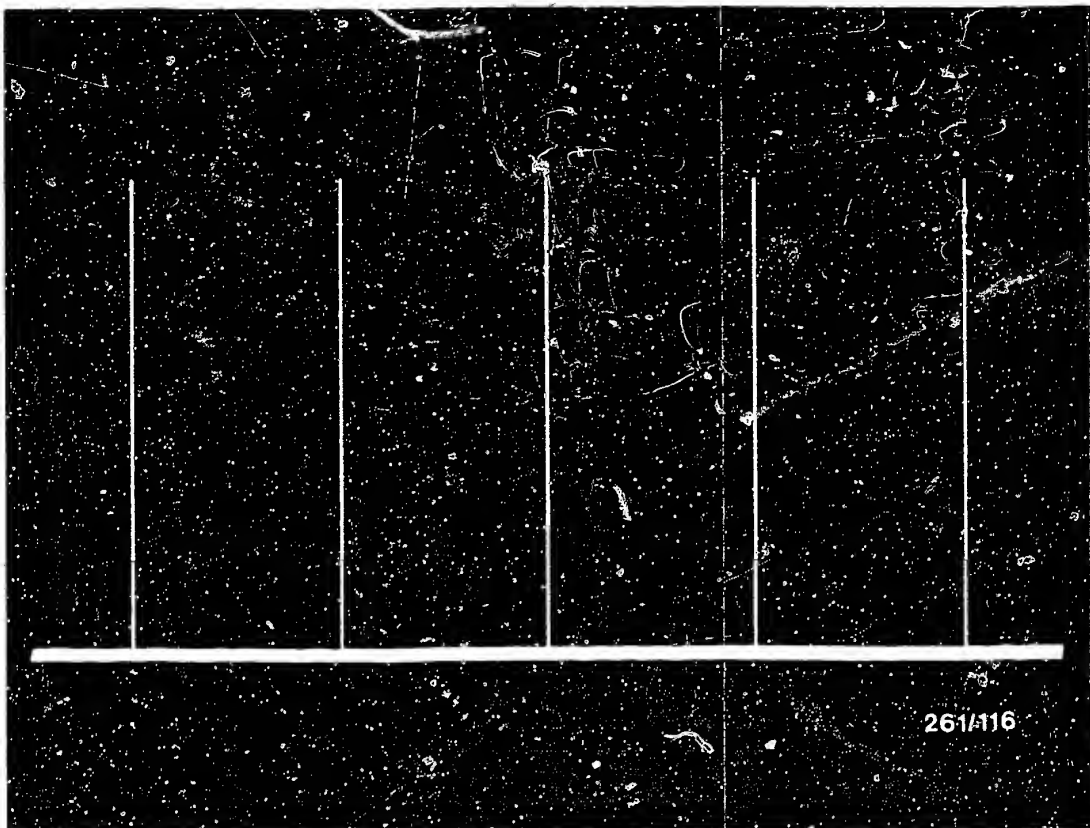
- 1 = Knock control unit
- 2 = Plug
- 3 = Connection - red clip of oscilloscope
- 4 = Test lead with resistor

Re-insert "comb" and plug 25-pin plug onto knock unit.

Connect test lead (with 1 k $\Omega$  resistor) to battery positive. Drive with the test lead connected. Test-drive vehicle at full load until loss of power can be detected. The customer complaint "no acceleration and no maximum engine power" must occur again.

Very important! After the fault has occurred, do not switch off the engine - continue idling.



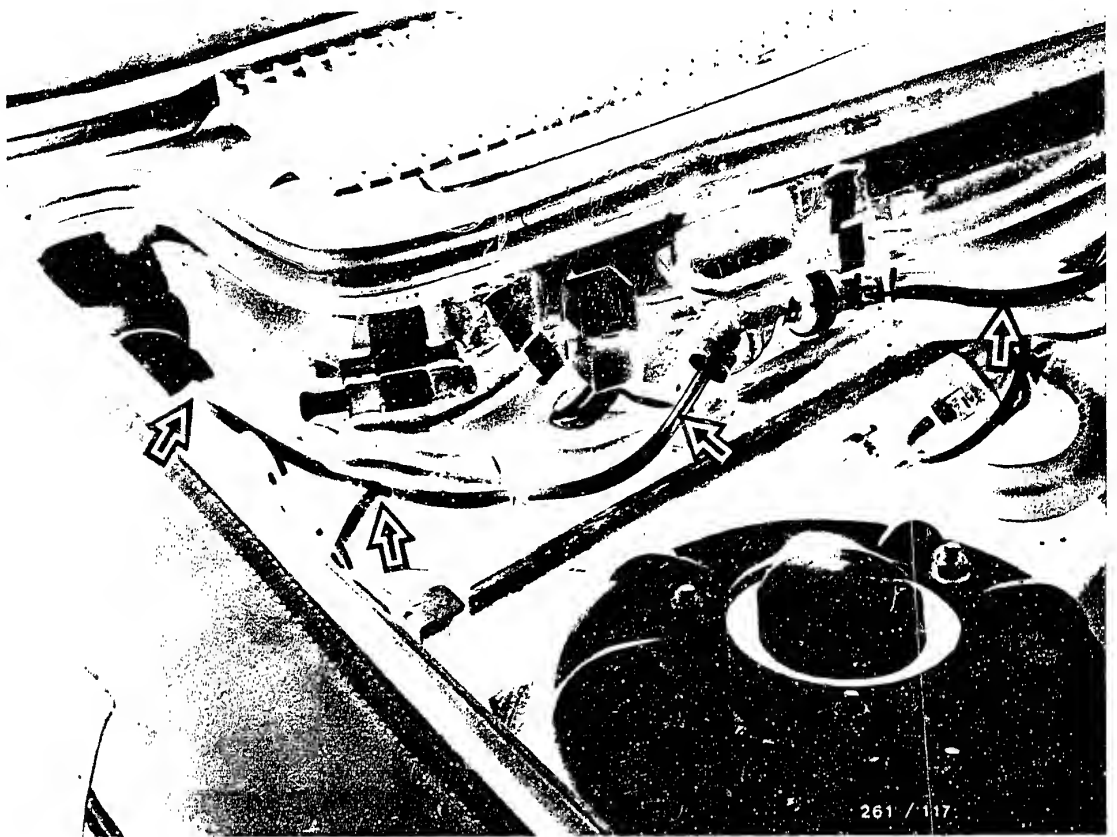


Diagnostic signal in case of fault.

Connect oscilloscope to test lead:  
Red clip to term. 3, black clip to ground.

Test lead remains connected via resistor to battery  
positive.

Note signals on oscilloscope:  
If there appear the spike pulses shown above, proceed  
as follows:



Arrows = Air hose from knock control unit to intake manifold

Test air hose from knock control unit to intake manifold:

Hose plug-in connections, non-return valve, no pinching, no leaks.

If visual examination is O.K., replace knock control unit.

**D1**

Diagnostic signal

BMW knock and charge-air pressure control



## Measure signal at solenoid-operated valve

Switch off ignition.  
Using suitable clamp, connect red clip for special input of ignition oscilloscope to negative terminal of solenoid-operated valve. To do this, slightly pull off plug on solenoid-operated valve. Negative terminal leads to knock control unit term. 2.  
Connect black clip to ground.  
Connect knock control unit.  
Let engine idle.

Observe signal on oscilloscope:



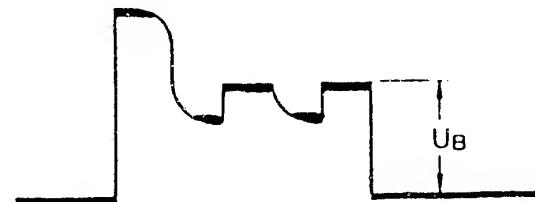
Signal present?

No

Replace knock control unit.

Yes

Give quick burst of acceleration and observe signal change:

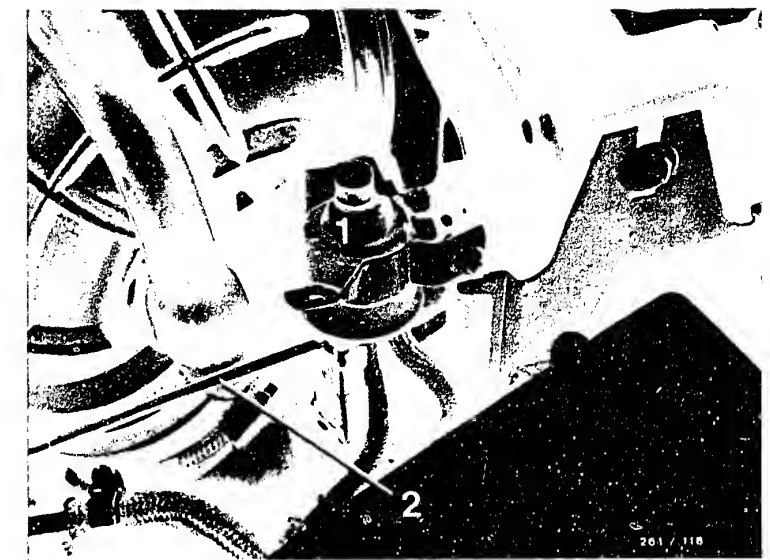


Signal appears only briefly.  
The width depends on the intensity of the burst of acceleration.

Signal present?

No

Replace knock control unit.



1 = Solenoid-operated valve  
2 = Test clamp

**D2**

Diagnostic signal

BMW knock and charge-air pressure control



**D3**

Diagnostic signal

BMW knock and charge-air pressure control



## 7.7 Test full-load function

Switch off ignition.  
Remove plug from knock control unit  
and remove cover from plug.  
Plug plug back onto knock control  
unit.  
Using suitable test prods, measure  
voltage at term. 13 (+) and term.  
12 (-).  
Let engine idle.  
Read off voltage.

4 ... 6 V

Voltage present?

Yes

Give brief burst of acceleration as  
far as full-load stop:  
Voltage briefly drops lower than at  
idle.

Voltage briefly lower?

Yes

Testing of knock control completed.

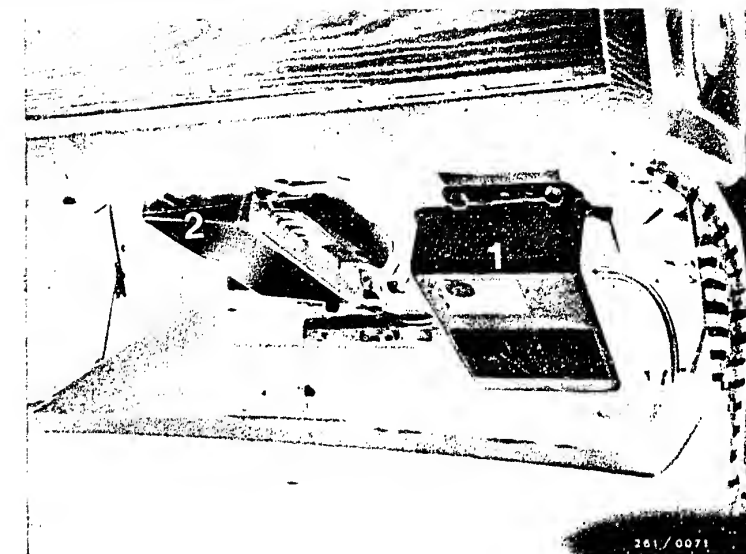
If fault has not been found, test  
Motronic and electronic transmission  
control - if this has not already  
been done.

No

Repeat test.  
Was burst of acceleration  
sufficient?  
Replace knock control unit.

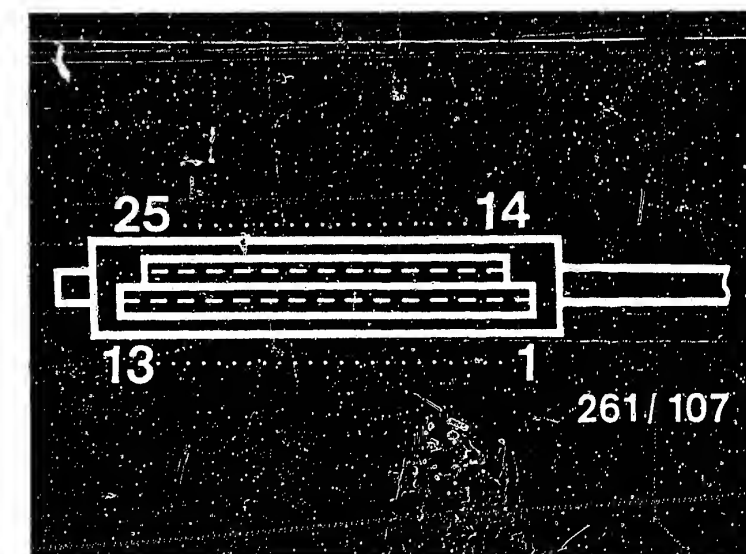
No

Repeat test.  
Was burst of acceleration  
sufficient?  
Replace knock control unit.



1 = Knock control unit  
(25-pin plug)  
2 = ABS controller  
(35-pin plug)

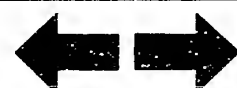
Top view of multiple plug



261/107

**D4**

Knock control unit full-load function  
BMW knock and charge-air pressure control



**D5**

Knock control unit full-load function  
BMW knock and charge-air pressure control



# After-sales Service

## Technical Bulletin

13-39

Only for use within the Bosch organization. Not to be communicated to any third party

KNOCK SENSOR

VDT-I-227/110 En

0 261 231 ..

3.1983

Procedures for after-sales service

### Description

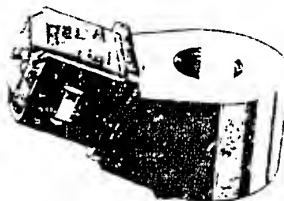
The knock sensor contains an active piezoceramic element. It is screwed to a chosen position on the engine block and sends a structure-borne signal which is processed further by an electronic control unit.

### User

Saab is the first vehicle manufacturer to use the knock sensor which is being fitted to various turbo vehicles.

### Components

Knock sensor 0 261 231 ... \*



\* The exact part numbers are given on the appropriate vehicle-equipment microcards AA... .

### Service/exchange parts

The knock sensor is a service part and is supplied by Bosch. The remaining components of the knock control are products made by other firms.

### Technical documentation

Technical bulletin "New product" VDT-I-227/10 En.

**BOSCH**

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**L1**

Technical Bulletin

BMW knock and charge-air pressure control



### Training

Special training is not necessary.

### Retrofitting

The knock sensor is not intended for retrofitting.

### Warranty procedure

Components on which a claim is being made should be sent for inspection during the warranty period to our representative in your country. He should forward it to:

ROBERT BOSCH GMBH  
KH/LAV - Auspackraum  
zur Weiterleitung an K1/VAK2  
7000 Stuttgart 30  
Federal Republic of Germany

This regulation applies until further notice.



## TABLE OF CONTENTS

<u>Section</u>	<u>Coordinates</u>
Structure of microfiche.....	A 1
1. Test specifications.....	A 2
2. Electrical terminal diagram.....	A 3
3. Basic diagram.....	A 6
4. Installation position of components.....	A 8
5. Necessary test equipment, aids.....	A 14
6. Important general information.....	A 15
7. Trouble-shooting.....	B 1
7.1 Visual examination in engine compartment.....	B 4
7.2 Test with universal test adapter (3 functions coming from transmis- sion plug.....	B 6
7.3 Resistance measurements of knock control components on plug of knock control unit.....	B 19
7.4 Voltage measurements on plug of knock control unit.....	C 7
7.5 Throttle-valve potentiometer Voltage test and adjustment.....	C 11



## Table of contents (continued)

<u>Section</u>	<u>Coordinates</u>
7.6 Signal tests with oscilloscope: Diagnosis and solenoid-operated valve.....	C 13
7.7 Test of full-load function.....	D 4
Technical Bulletin Knock sensor, after-sales service procedure.....	L 1

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